भाकृअनुप
ICAR

भारतीय कृषी अनुसंधान परिषद्
INDIAN COUNCIL OF
AGRICULTURAL RESEARCH

वार्षिक रिपोर्ट
Annual Report
1992-93

केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN

Front cover photo

Green mussel *Perna viridis*– an emerging shellfish resource and seafood offering scope for extensive seafarming for which proven technologies have been developed by the Institute.

Back cover photo

Cardinal fishes– a potential resource in Lakshadweep for utilisation as live-bait in pole-and-line fishing for tunas.

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE COCHIN

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE
REGIONAL CENTRE
MANGALORE
3/5/94

Annual Report 1992 - '93

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INDIAN COUNCIL OF AGRICULTURAL RESEARCH

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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

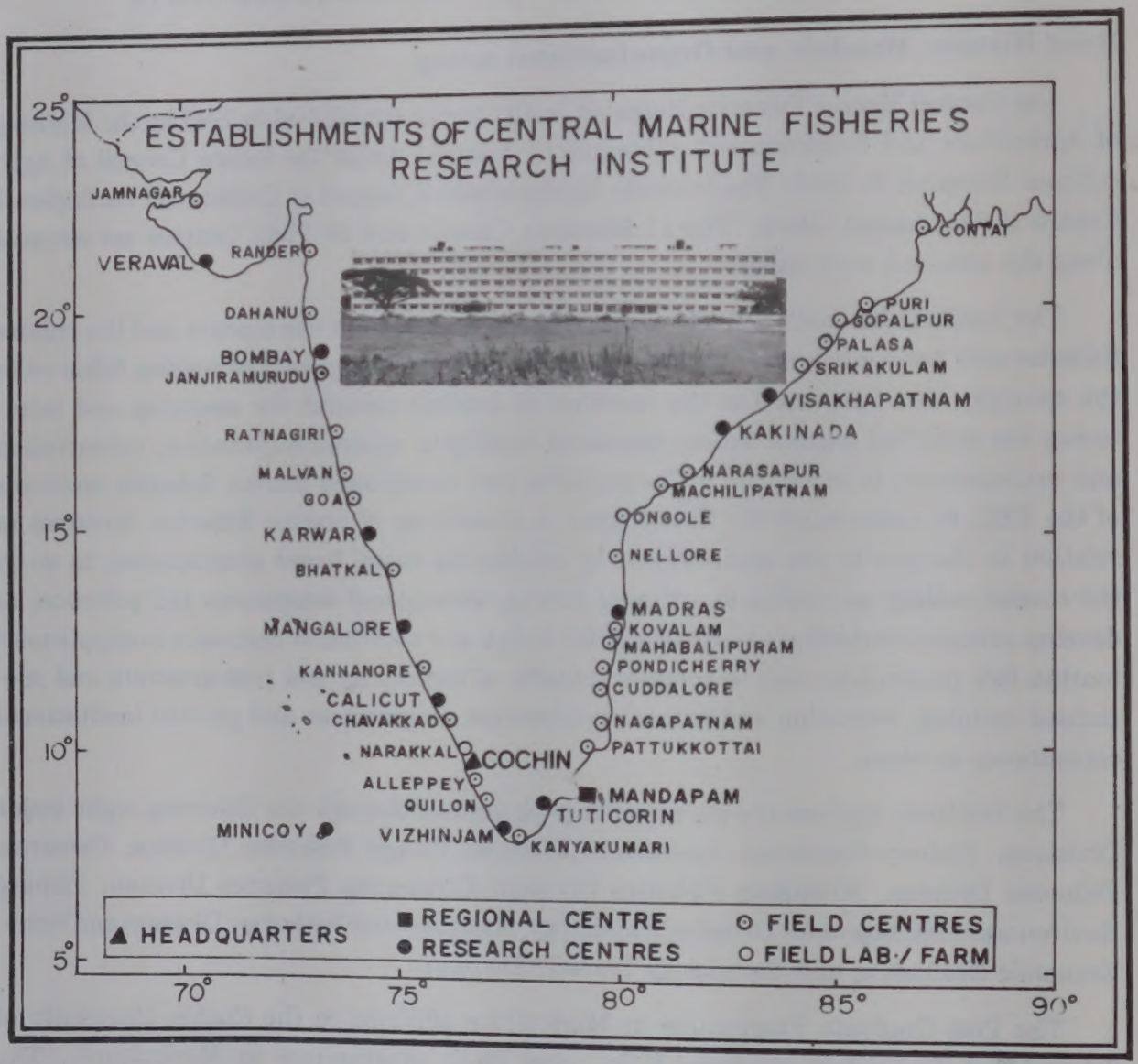
Brief History, Mandate and Organisational set-up

The Central Marine Fisheries Research Institute was established in 1947 by the Ministry of Agriculture and Irrigation and subsequently brought under the Indian Council of Agricultural Research in 1967. The Institute headquarters is located at Cochin and its Regional Centre at Mandapam Camp. The 11 Research Centres and 28 Field Centres are situated along the east and west coasts.

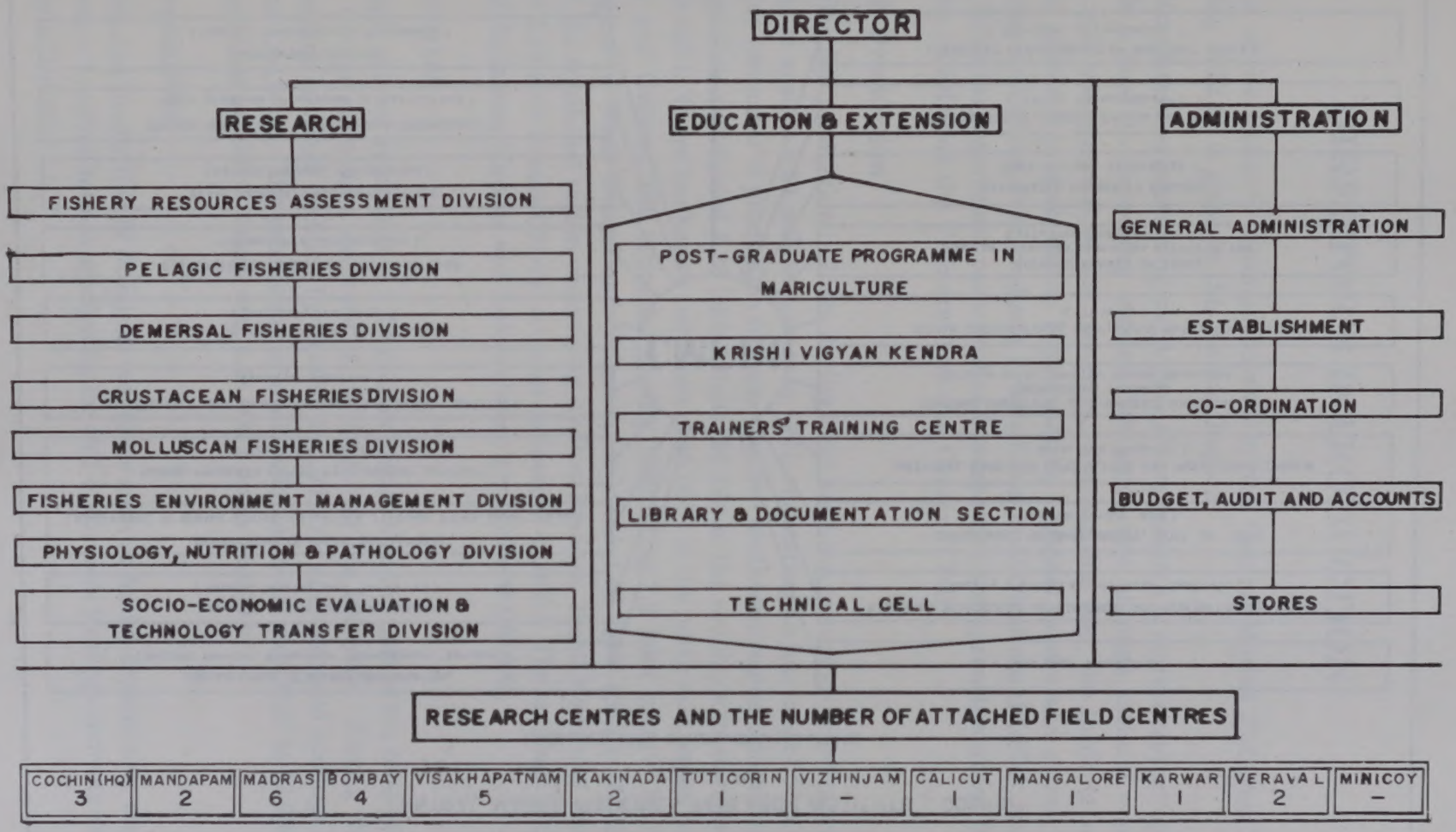
The Institute has been actively conducting research both in the capture and the culture fisheries and has contributed significantly to the overall development of marine fisheries in the country. The Institute has the mandate to conduct research for assessing and monitoring the exploited marine fishery resources leading to rational exploitation, conservation and management; to assess the under-exploited and unexploited marine fisheries resources of the EEZ; to understand the fluctuations in abundance of marine fisheries resources in relation to changes in the environment by conducting vessel based programmes; to study the coastal ecology as related to artisanal fishing, endangered ecosystems and pollution; to develop suitable mariculture technologies for finfish and shellfish in open seas to supplement marine fish production; and to conduct transfer of technology and post-graduate and specialised training, education and extension education programmes and provide institutional consultancy services.

The Institute implements its research programmes through the following eight major Divisions: Fishery Resources Assessment Division; Pelagic Fisheries Division; Demersal Fisheries Division; Molluscan Fisheries Division; Crustacean Fisheries Division; Fishery Environment Management Division; Physiology, Nutrition and Pathology Division and Socio-Economic Evaluation and Technology Transfer Division.

The Post-Graduate Programme in Mariculture affiliated to the Cochin University of Science and Technology conducts M.Sc. and Ph.D. programmes in Mariculture. The Library and Documentation Section provides reference facilities to the staff and students of the Institute and to visitors both within and outside the country. It is also responsible for bringing out the Institute's publications. The Krishi Vigyan Kendra and Trainers' Training Centre at Narakkal are involved with extension programmes and imparting training in capture and culture fisheries.

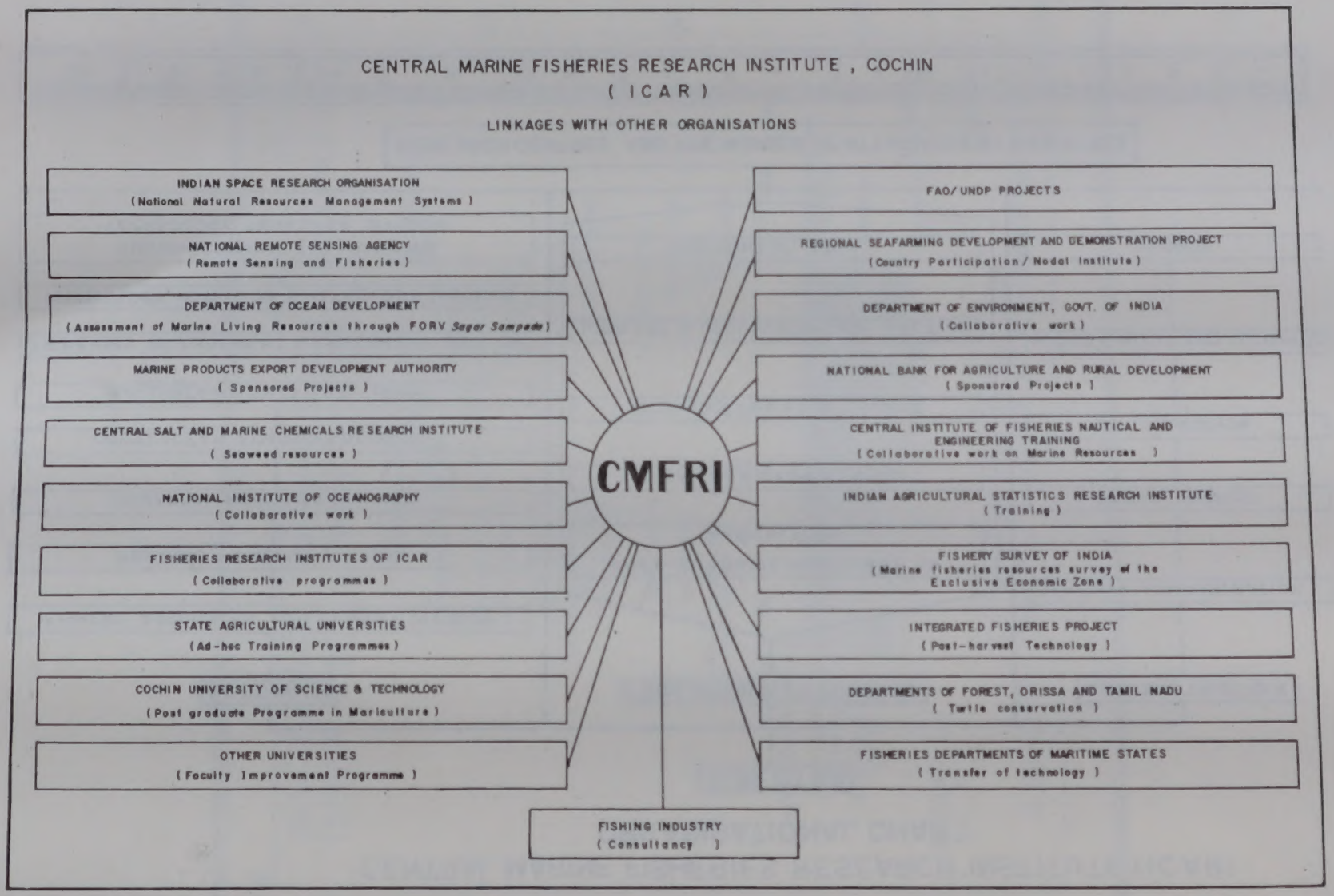

ESTABLISHMENTS OF CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
JAMNAGAR
VERAVAL
RANDER
DAHANU
BOMBAY
JANJIRAMURUDU
RATNAGIRI
MALVAN
GOA
KARWAR
BHATKAL
MANGALORE
KANNANORE
CALICUT
CHAVAKKAD
NARAKKAL
COCHIN
ALLEPPEY
QUILON
MINICOY
VIZHINJAM
KANYAKUMARI
TUTICORIN
MANDAPAM
PATTUKKOTTAI
NAGAPATNAM
CUDDALORE
PONDICHERRY
MAHABALIPURAM
KOVALAM
MADRAS
NELLORE
ONGOLE
MACHILIPATNAM
NARASAPUR
KAKINADA
VISAKHAPATNAM
SRIKAKULAM
PALASA
GOPALPUR
PURI
CONTAI
HEADQUARTERS
REGIONAL CENTRE
RESEARCH CENTRES
FIELD CENTRES
FIELD LAB./ FARM
25°
20°
15°
10°
5°
70°
75°
80°
85°
90°

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE (ICAR)
ORGANISATIONAL CHART



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE , COCHIN
(ICAR)

LINKAGES WITH OTHER ORGANISATIONS


INDIAN SPACE RESEARCH ORGANISATION
(National Natural Resources Management Systems)
NATIONAL REMOTE SENSING AGENCY
(Remote Sensing and Fisheries)
DEPARTMENT OF OCEAN DEVELOPMENT
(Assessment of Marine Living Resources through FORV Sagar Sampada)
MARINE PRODUCTS EXPORT DEVELOPMENT AUTHORITY
(Sponsored Projects)
CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE
(Seaweed resources)
NATIONAL INSTITUTE OF OCEANOGRAPHY
(Collaborative work)
FISHERIES RESEARCH INSTITUTES OF ICAR
(Collaborative programmes)
STATE AGRICULTURAL UNIVERSITIES
(Ad-hoc Training Programmes)
COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY
(Post graduate Programme in Mariculture)
OTHER UNIVERSITIES
(Faculty Improvement Programme)
CMFRI
FISHING INDUSTRY
(Consultancy)
FAO/UNDP PROJECTS
REGIONAL SEAFARMING DEVELOPMENT AND DEMONSTRATION PROJECT
(Country Participation / Nodal Institute)
DEPARTMENT OF ENVIRONMENT, GOVT. OF INDIA
(Collaborative work)
NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT
(Sponsored Projects)
CENTRAL INSTITUTE OF FISHERIES NAUTICAL AND ENGINEERING TRAINING
(Collaborative work on Marine Resources)
INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(Training)
FISHERY SURVEY OF INDIA
(Marine fisheries resources survey of the Exclusive Economic Zone)
INTEGRATED FISHERIES PROJECT
(Post-harvest Technology)
DEPARTMENTS OF FOREST, ORISSA AND TAMIL NADU
(Turtle conservation)
FISHERIES DEPARTMENTS OF MARITIME STATES
(Transfer of technology)

DIRECTOR'S INTRODUCTION

A resume of the research accomplishments by the Central Marine Fisheries Research Institute during 1992-93 is given in this Annual Report.

The Institute has been conducting multi-disciplinary research in marine capture and culture fisheries with a view to increasing marine fish production through rational exploitation, conservation and managament of the resources. During this year the Institute undertook 57 need-based research projects at the Headquarters, Regional Centre and eleven Research Centres, besides continuing Post-graduate Programmes in Mariculture (PGPM), training for fish farmers, fisheries department personnel and prospective entrepreneurs under the Krishi Vigyan Kendra (KVK) and the Trainers' Training Centre (TTC).

Marine Fish Production

The marine fish production in India during 1992 has been provisionally estimated at 2.29 million tonnes as against 2.24 million tonnes in 1991, registering an increase of 50,000 tonnes. The regionwise estimates of production indicate that the southwest region comprising Kerala, Karnataka and Goa contributed 8.26 lakh tonnes (36.1%) to the country's total, registering an increase of 29,000 t. There has been a reduction of 45,000 t in the northwest region comprising Maharashtra and Gujarat, the estimates during 1992 being 7.8 lakh tonnes (34.1%). The northeast region of West Bengal and Orissa contributed 1.27 lakh tonnes (5.5%), up by 15,000 t, and the southeast region comprising Andhra Pradesh, Tamil Nadu and Pondicherry accounted for 5.34 lakh tonnes (23.4%) with an increase of 45,000 t. The landings in the Union Territories of Andaman-Nicobar and Lakshadweep were 20,000 t (0.9%).

Pelagic resources

The pelagic species amounted to 1.19 million tonnes forming 52% of the total production, 2.29 million tonnes showing a decrease of 10,734 t over the last year. Among the pelagic groups, oil sardine landings declined by 73,000 t to 1,04,000 t and mackerel landings increased by 20,000 t to 1,34,000 t. The production of whitebaits has been estimated at 81,000 t, down by 4,000 t, and that of ribbon fishes, was 1,11,000 t up by 16,000 t.

Demersal resources

The estimated production of demersal resources such as fishes, crustaceans, cephalopods and others was 1.1 million tonnes accounting for 48% of the total landings showing an increase of 45,000 t over last year.

a) **Fishes:** The commercially important groups were the elasmobranchs (62,000 t), catfishes (36,000 t), pomfrets (33,000 t), perches (1,14,000 t), croakers (1,62,000 t) and silverbellies (51,000 t). The first three groups have shown decrease in landings compared to last year.

b) **Crustaceans:** With an estimated total landings of 2.78 lakh tonnes, the prawn production in India during 1992 registered a decrease of 5.7% from that of the previous year. Penaeids contributed 1.86 lakh tonnes while the non-penaeids 91,274 t. At Veraval on the west coast the non-penaeids continued to dominate in the trawl catches. On the Kerala coast the ban on monsoon trawling for 22 days did not make any impact on the fishery as trawlers operated beyond territorial waters. A remarkable improvement in *Parapenaeopsis stylifera* fishery at Sakthikulangara (Kerala) was observed with catch of 15,318 t during the monsoon period which is a record since 1980. For the first time a bioeconomic study of the shrimp fishery of the northeast coast has been carried out by applying the BEAM method developed by FAO. The study showed that the shrimp fishery of this region will be more economical for small and medium-sized trawlers than for large trawlers.

c) **Cephalopods:** The cephalopod production in the country has further improved during this year. The annual landings were 89,500 t, an increase of 24,000 t over the previous year, accounting for 4.1% of the total fish production. The fishery was mainly supported by three species, the squid *Loligo duvauceli* and cuttlefishes *Sepia pharaonis* and *S. aculeata.*

d) **Other molluscs:** The annual production of green mussel *(Perna viridis)* on the Malabar coast was about 5,100 t. The landings of black clam *(Villorita cyprinoides)* from Vembanad Lake was good at Muhamma (7,315 t) and Vechoor (2,653 t). There was no regular licenced chank fishery in the Palk Bay and the Gulf of Mannar. However, over 1,26,000 chanks were landed in Ramnad District as by-catch in trawl fishing.

Environmental studies

Important environmental parameters have been collected from different centres. The Sea Truth Data such as sea surface temperature and chlorophyll collected during the special cruises of FORV *Sagar Sampada* are being studied in relation to satellite data obtained from the National Remote Sensing Agency (NRSA) for identifying potential fishery areas. The data on potential fishing zones (PFZ) received from NRSA are disseminated to various agencies and the feedback information obtained from them are compared with PFZ forecast. The Marine Remote Sensing Information System (MARSIS) with computer facilities has recently been set up at the Institute.

Physiology & Nutrition

Significant studies have been made in long-term preservation of sperm motility of certain marine fishes like *Liza parsia, Sillago sihama*, and *Mugil cephalus.* Evaluation of data collected from several shrimp farms at Nellore District of Andhra Pradesh showed that proper selection

of feed ingredients, appropriate feed particle size, judicious feeding and water quality management imparted to the farmers have improved the feed conversion rates (1.0 to 1.8).

Fishery economics

The introduction and further enhancement of ring seine operation with progressive motorisation of traditional fishing craft are changing the fishing scenario on the Kerala coast. Even bigger type of plank-built boats are now being used in North Kerala, which can accommodate 30 to 35 crew members. Thus the investment requirement of a ring seine unit has increased very much.

Mariculture

One of the significant achievements in mariculture research is the re-maturation of the prawn *Penaeus semisulcatus* by environmental manipulation. A single prawn has spawned eight times during one year, always releasing viable eggs. From two experiments involving four prawns each, a total of 11 lakhs of post-larvae has been produced and released into Palk Bay. A technology has also been developed for the first time to transport nauplii of *Penaeus indicus* at the rate of 1 lakh nauplii per litre with 100% survival over a journey period of 24 hours from Tuticorin on the east coast to Cannanore on the west coast. This may reduce the cost of production of prawn seed in the hatchery. Under the sea-ranching programme for marine prawns, 13.7 lakh hatchery-reared post-larvae of *Penaeus semisulcatus* were released into Palk Bay at Mandapam to supplement the natural stocks. The fishermen who took up the project have been acquainted with all activities of pearl culture, at Valinokkam.

The studies made so far under the composite seafarming of molluscs, sea cucumber, prawns, seabass and seaweeds at Valinokkam, a coastal village near Tuticorin in Tamil Nadu, indicate that this area is highly suited for the culture of pearl oyster, sea cucumber and seaweeds.

Vessel-based Programme

During the year the Institute has undertaken three research cruises by FORV *Sagar Sampada* off the west coast of India to study the seasonal variability of biological productivity in the EEZ and to correlate the productivity pattern with the environmental parameters during the premonsoon, monsoon and postmonsoon periods.

The *Cadalmin* series of vessels stationed at seven centres monitored the environmental parameters in the inshore fishing grounds.

Education, Training and Transfer of Technology

Under the Institute's programme in post-graduate education and research to impart courses in mariculture leading to M.Sc. and Ph.D. degrees, all the 10 Junior Research Fellows of the 11th batch passed the M.Sc. Mariculture Examination in the First Class and those of the 12th

batch are currently undergoing the course. Under the Ph.D. programme, five Senior Research Fellows were awarded the degrees by the Cochin University of Science and Technology.

Under the upgradation, location testing and transfer of technology programme, pearl culture has been carried out at Valinokkam. A Pearl Festival was organised at Valinokkam on 4th May, 1992 to mark the success of the transfer of technology programme on cultured pearl production. A pilot-scale project for edible oyster culture was taken up with the involvement and partial funding by NABARD. The first edible oyster harvest mela was held on 27th March, 1993.

The Krishi Vigyan Kendra conducted 43 training courses involving 972 participants. The Trainers' Training Centre organised 8 courses for 65 trainees.

Long-term perspective plan for Research & Development in marine fisheries

The Institute has prepared a document 'Long Term Perspective Plan for Research and Development in Marine Fisheries' which is now under the consideration of ICAR.

Awards

It is noteworthy that at the 'INDAQUA-93' organised by the Marine Products Export Development Authority at Madras, 12 Scientists of this Institute were honoured with awards for their outstanding contribution in the field of aquaculture development.

P.S.B.R. James

(P.S.B.R. JAMES)
Director

PEARL FESTIVAL AT VALINOKKAM

Pearl Festival at Valinokkam, 4 May 1992. Dr. P.S.B.R. James, Director, CMFRI welcomes the gathering. Sitting from left are Dr. V. Rajeswaran, M.P., Shri K.C. Lenka, Hon'ble Minister of State for Agriculture; Dr. P.V. Dehadrai, Deputy Director General, ICAR, and Dr. Richard Masillamony, Vice-Chancellor, Tamil Nadu Veterinary and Animal Sciences University, Madras.

FARMERS REWARDED

Hon'ble Minister Shri K.C. Lenka distributing the share of pearls to the fishermen and pearl farmers who were actually involved in the pearl culture programme of the Institute at Valinokkam.

D.G.'s VISIT

Dr. V.L. Chopra, Director General, ICAR, examines the pearls cultured at Tuticorin Research Centre.

EDIBLE OYSTER HARVEST MELA

Shri D. Jayakumar, Hon'ble Minister for Fisheries, Tamil Nadu releasing the Brochure on Edible Oyster at the Edible Oyster Harvest Mela, 27 March' 93 at Tuticorin to mark the first harvest of oysters under NABARD - aided pilot-scale demonstration project. Receiving the brochure is Shri M.R. Janardhanan, M.P., Thirunelveli, flanked by (from left) Dr. K. Gopakumar, Director, CIFT., Dr. P.S.B.R. James, Director, CMFRI, and Shri Hemanth Kumar Sinha, IAS. Collector, Chidambaranar Dist.

Shri D. Jayakumar, Hon'ble Minister, along with other dignitories examining part of the edible oysters harvested during the Mela.

PROGRESS OF RESEARCH

FISHERY RESOURCES ASSESSMENT DIVISION

MARINE FISH PRODUCTION IN INDIA DURING 1992

Marine fish production in India during 1992 has been provisionally estimated at 2.29 million tonnes as against 2.24 million tonnes of 1991, registering an increase of 44,000 tonnes (2.0%). The percentage contribution by pelagic and demersal groups were 52 and 48 respectively. Of the total of 2.29 million tonnes 81% was from the mechanized sector including out-board (OB) units and the rest from non-mechanized units. The production from west coast accounted for 70.2% (16,16,000 t) and east coast 28.8 % (6,70,000 t). Among the commercially important fishes, oil sardine landings declined by 73,000 t and penaeid prawns by 3,500 t. However, there was an increase of 20,000 t in the landings of mackerel.

Table - 1

Regionwise production of marine fishes during 1992 (in tonnes)

Region	Annual production	Percentage to all India production
Northeast (West Bengal & Orissa)	126,408	5.5
Southeast (Andhra Pradesh, Tamil Nadu, & Pondicherry)	534,285	23.4
Southwest (Kerala, Karnataka & Goa)	825,889	36.1
Northwest (Maharashtra & Gujarat)	779,928	34.1

Besides, Island territories contributed 0.9 % of total production.

REGIONWISE PRODUCTION OF MARINE FISHES

NORTHEAST REGION

Northeast region contributed 1,26,000t (5.5%) to the total landings registering an increase of 15,000 t (13%) compared to 1991. Though, the total landings increased by 15,000 t, the landings of Hilsa shad decreased by 5,000 t from 25,000 t of 1991 to 20,000 t of 1992. The landings of Bombay duck contributed 21,000 t to the total production and an increase of 11,000 t was noticed.

SOUTHEAST REGION

Southeast region accounted for 23.4 % of the total estimated marine fish landings of India. An increase of 45,000 t (9%) was recorded in this region, compared to the estimate of 1991. A substantial increase of 38,000 t in the landings of mackerel was recorded, the estimate during 1992 being 59,000 t. Oil sardine landing was to the tune of 38,000 t, an increase of 4,000 t noticed, compared to the estimate of 1991.

Table – 2

Estimated landings (in tonnes) of pelagic fishes in India during 1991 and 1992

Name of fish	1991	1992*
CLUPEIDS		
Wolf herring	16063	17415
Oil sardine	176887	104062
Other sardines	86317	93300
Hilsa shad	27727	22375
Other shads	13676	11273
Anchovies	90	904
Coilia	43066	31360
Setipinna	2410	2748
Stolephorus	85526	81231
Thrissina	3	0
Thryssa	33917	45677
Other clupeids	51494	59570
BOMBAY DUCK	136450	127164
HALF BEAKS & FULL BEAKS	2543	2389
FLYING FISHES	5619	4917
RIBBONFISHES	95428	111021
CARANGIDS		
Horse mackerel	19204	19545
Scads	102001	117810
Leather-jackets	4263	5840
Other carangids	43158	46542
MACKERELS		
Indian mackerel	113658	133884
Other mackerels	17	1
SEERFISHES		
S. commerson	16794	24393
S. guttatus	20039	17386
S. lineolatus	46	1027
Acanthocybium spp.	529	88
TUNNIES		
E. affinis	17624	23460
Auxis spp.	5407	7895
K. pelamis	4967	5282
T. tonggol	3727	2455
Other tunnies	4523	3183
BILLFISHES	791	1387
BARRACUDAS	13373	12399
MULLETS	6602	5114
UNICORN COD	1492	1188
MISCELLANEOUS	41806	42218
PELAGIC TOTAL	**1197237**	**1186503**

* Provisional

SOUTHWEST REGION

The contribution of southwest region to the total production was 8,26,000 t (36.1%) registering an increase of 29,000 t (3.7%) as against the estimate of 1991. The region witnessed reduced landings in all the major commercially important fishes, namely oil sardine, mackerel, penaeid prawns and *Stolephorus* spp. Oil sardine landing was 66,000t during 1992 which showed a drastic reduction of 76,000 t. *Stolephorus* spp. landings also reduced by 3,000 t from 57,000t to 54,000t. Landing of mackerel during 1992 was 61,000 t which showed a reduction of 18,000t, compared to the estimate of 1991. Penaeid prawn landing was to the tune of 65,000 t which also recorded a decline of 7,900 t. However, there had been improvements in the fishery of clupeids by 24,000t, carangids by 16,000 t, soles by 27,000 t, cephalopods by 10,000 t and stomatopods by 14,000 t.

NORTHWEST REGION

Northwest region contributed 34.1% (7,80,000 t) to the total production of the country during 1992. The estimate showed a decline of 45,000 t (5.4%), compared to the estimate of 1991. Among the major groups, Bombay duck showed a decline of 19,000 t compared to the estimate of 1991. The estimate of Bombay duck was

1,06,000t during the year. The landings of *Coilia* spp.amounted to 26,000t and a reduction of 12,000t was noticed in the region. Pomfret fishery also showed a declining trend. The estimate of pomfret was 17,000t which showed a decline of 9,000t. The landings of non-penaeid prawn was 87,000t which recorded a decline of 8,600t. However, landings of croakers and ribbonfishes have increased by 11,000t and 10,000t, the estimate being 1,05,000t and 70,000t respectively. The penaeid prawn landing did not show much change (85,000t) during 1992.

Pelagic groups (Table - 2) accounted for 52% and demersal groups (Table -3) 48% during 1992.

Oil sardine: Oil sardine fishery during 1992 suffered a set back. Oil sardine accounted for 4.6% of the marine fish production and formed 8.8% of the pelagic resources. The estimated landing was 1,04,000 t which registered a decline of 73,000t (41%). The reduction was solely noticed in the southwest region (76,000 t).

Mackerel: Mackerel formed 5.8% of the total marine fish landings of the country and accounted for 11.3% of the pelagic resources. Mackerel landing during the year was 1,34,000 t which showed an increase of 20,000 t (17%) compared to 1991. Southeast region recorded an increase of 38,000 t to the total production whereas a reduction of 18,000 t was noticed by the southwest region.

***Stolephorus* spp.:** *Stolephorus* spp. accounted for 3.5% of the total marine fish landings of the country. An estimate of 81,000 t was recorded during 1992 showing a reduction of 4,000t. The production of *Stolephorus* spp. accounted for 6.8% of the pelagic resources.

Bombay duck: Bombay duck landings formed 5.6% of the total marine fish production and accounted for 10.6% of the pelagic resources of the country. The estimated landings during 1992 was 1,27,000 t showing a decline of 9,000 t. Northwest region contributed 83.4% (1,06,000 t) of the total Bombay duck production of the country which recorded a decline of 19,000 t compared to 1991. However, northeast region contributed 20,000 t which showed an increase of 10,000 t.

Carangids: Carangids formed 8.3% of the total marine fish production of the country and accounted for 16.0% of the pelagic resources. The landing of carangids was estimated at 1,90,000 t during 1992 and an increase of 21,000 t was noticed. Southwest region contributed 76.8% of the carangid landings registering an increase of 18,000 t compared to previous year.

Ribbonfishes: Ribbonfishes accounted for 4.8% of the total marine fish production and 9.3% of the pelagic resources of the country during 1992. The estimated landing was 1,11,000 t which registered an increase of 16,000 t compared to 1991. Northwest region contributed 63.2% and southwest region 12.6%. The contribution of southeast region amounted to 19.5% and the rest was from northeast region. An increase of 10,000t in the landings was noticed in the northwest region and 8,000 t in southwest region.

Tunnies: Tunnies accounted for 1.9% of the total marine fish landings of the country during 1992 and formed 3.6% of the exploited pelagic resources. The estimated landing was 42,000t which showed a slight increase of 3,500 t, compared to previous year.

Table - 3

Estimated landings (in tonnes) of demersal fishes in India during 1991 and 1992

Name of fish	1991	1992*
ELASMOBRANCHS		
Sharks	32427	44303
Skates	1211	1935
Rays	17425	16006
Eels	6873	6546
Catfishes	39374	36248
LIZARD FISHES	27573	28939
PERCHES		
Rock cods	6203	8548
Snappers	2228	2762
Pig-face breams	5134	4423
Threadfin breams	63019	67982
Other perches	26552	30688
GOATFISHES	33298	17242
THREADFINS	7849	7811
CROAKERS	145584	161843
SILVERBELLIES	52133	51383
BIG-JAWED JUMPER	9794	6575
POMFRETS		
Black pomfret	14425	10791
Silver pomfret	28105	22867
Chinese pomfret	119	245
FLATFISHES	1	5
Halibut	2527	2007
Flounders	639	933
Soles	34103	60399
CRUSTACEANS	16	47
Penacid prawns	190434	186880
Non-penacid prawns	100606	91274
Lobsters	2254	2011
Crabs	28489	27090
Stomatopods	62674	72688
MOLLUSCS	2	0
Bivalves	2025	302
Gastropods	201	894
Cephalopods	65337	89482
MISCELLANEOUS	36579	39193
DEMERSAL TOTAL	**1045213**	**1100342**

* Provisional

Catfishes: Catfishes formed 1.6% of the total marine fish landings and accounted for 3.3% of the demersal resources. The estimated landing was 36,000 t during the year which showed a reduction of 3,000 t compared to 1991. Northwest region contributed 55.6%, (20,000 t) and northeast region 27.8% (10,000t).

Elasmobranchs: The landings of sharks, rays and skates together formed 2.7% of the total marine fish landings of the country during 1992. The estimated landings amounted to 62,000 t which formed 5.7% of the total demersal resources. Northwest region contributed 43.7% (27,000 t) and southeast region 38.8% (24,000 t).

Perches: The perches accounted for 5% of the total catch of the country and 10.4% of the demersal resources. During 1992 estimated landing was 1,14,000t which showed an increase of 11,000 t. Southwest region contributed 48.2% (55,000 t) and northwest region 22.8% (26,000 t). Both these regions showed improvements in the catches.

Croakers: The landings of croakers showed an increase of 16,000 t compared to 1991. During 1992, an estimated 1,62,000 t of croakers were landed and formed 7.0% of the total marine fish landings and 14.7% of the demersal resources. Northwest region contributed 62.9% and southwest region 13.0%. An increase of 11,000 t and 6,000 t was noticed in these two regions respectively.

Silverbellies: Silverbellies accounted for 2.2% of the total marine fish landings of the country and 4.7% of the demersal resources. The estimate during 1992 was 51,000 t. Southeast region contributed 78.5% of the catch which showed a slight improvement of 2,000t. However, southwest region contributed 12.5% recording a decline of 2,000 t.

Pomfrets: The estimated landing of pomfrets during 1992 was 33,000 t which formed 1.4% of the total marine fish landings of the country accounting for 3.1% of the demersal landings. There was a reduction of 9,000 t in the landings during 1992. Northwest region contributed 51.2% (17,000 t) to the total pomfret landings and the reduction of 9,000 t was attributed to this region. Northeast region recorded 7,000 t of pomfrets, next to northwest.

Penaeid prawns: Penaeid prawns formed 1,87,000t (8.2%) of the total marine fish production of the country which showed a reduction of 3,500 t compared to 1991. Penaeid prawns formed 17.0% of the total exploited demersal resources. Northwest region contributed 45.5% and southwest region 34.8% of the total penaeid prawn production of the country. A reduction of 8,000 t was noticed in the southwest region whereas northwest region did not depict any significant change compared to 1991. Southeast region contributed 16.6% of the penaeid prawn landings.

Non-Penaeid prawns: Non-penaeid prawns formed 4.0% of the total marine fish production of the country and 8.3% of the demersal landings. Of the total non-penaeid production of 91,000 t, northwest region alone contributed 95.9% of the landings and a reduction of 9,000 t was noticed in this region when compared to 1991. Production from northeast and southeast regions were of the order of 2,000 t each.

Cephalopods: Cephalopods formed 3.9% of the total marine fish landings and accounted for 8.1% of the exploited demersal landings. The estimated landings during 1992 was 89,000 t which showed an increase of 24,000 t compared to 1991. Northwest region contributed 43.8% (39,000 t) and southwest region 38.2% (34,000 t), the increases in the two regions were 7,000 t and 10,000 t respectively. Southeast region contributed 19.1% of total cephalopod landings and an increase of 7,000 t was noticed.

Mechanized and non-mechanized landings

Mechanized landings during 1992 accounted for 83.2% of the total production. Compared to the estimate of 1991, a slight increase in this sector was noticed. Units having power for fishing and propulsion accounted for 53% of the catch and propulsion alone 30%. Units having propulsion and fishing, namely, Category I, type brought 12,20,000 t in 1992. Compared to the estimate of 1991, an increase of 1,13,000 t was recorded in 1992 by the units under this category. Units having power for propulsion (Category II) contributed 6,88,000 t to the total production in 1992. However, landings by the units of this category was reduced by 68,000 t. The reduction was primarily noticed in the catches of outboard units in the southwest region. Landings by the non-mechanized units formed 3,83,000 t which did not show any significant change compared to 1991.

Effort expended and total catch by different types of units are presented in Table 6. There was increase in the effort both in the units under Category I and Category II. However, there was reduction in the effort expended in the non-mechanized sector. Effort put in by units under Category I and II together was 51,18,000 t in 1992 whereas the estimated effort in 1991 was 50,14,000 t. However, effort was reduced during 1992 in the non-mechanized sector, from 74,17,000 t to 69,48,000 t.

Table-4 gives percentage contribution of different categories of units (I,II & III) by the different regions to the total production of the country during 1991 and 1992.

Southwest region contributed 4,96,000 t (53%) of the total production by the units under Category I which showed an increase in this sector when compared to 1991. About 95% of the production from the southwest was by the mechanized units in 1992 which showed an increase. In northwest region, mechanized catch accounted for 89% of the production.

Table - 4

Percentage contribution of different categories of units

Region	1991			1992		
Category	I	II	III	I	II	III
Northeast	21.2	57.9	20.9	22.0	64.0	14.0
Southeast	46.8	11.2	42.0	46.7	11.6	41.7
Southwest	53.8	39.7	6.5	60.0	35.3	4.7
Northwest	51.0	38.8	10.2	56.8	32.4	10.8

Category I - Mechanized units (Fishing & Propulsion)
Category II - Mechanized units (Propulsion alone)
Category III - Non-mechanized units

Table - 5

Percentage contribution of three categories of units in the region-wise production

Region	1991			1992		
Category	I	II	III	I	II	III
Northeast	2.1	8.6	6.4	2.3	11.8	4.8
Southeast	20.8	7.2	56.4	20.5	9.0	61.3
Southwest	38.9	41.8	14.2	40.8	42.4	10.7
Northwest	38.2	42.4	23.0	36.4	36.8	23.2

Table-5 gives the percentage contribution of four different regions to the fish production of India by the units under the three categories. Southwest region contributed 40.8% of the production under Category I which recorded an improvement. The production by units under Category II was 42.4% in southwest coast which showed a decline.This decline in the production was by the lesser landings of units fitted with outboard motors. 61.3% of the catch in the southeast region was by the non-mechanized units.

Table - 6

Catch (tonnes) Effort (units) and CPUE (kg) in 1991 & 1992

Regions		1991			1992		
		Catch	Effort	CPUE	Catch	Effort	CPUE
Northeast	I	23656	85	278	27941	94	297
	II	64716	192	337	80969	260	311
	III	23421	513	46	17498	397	44
Southeast	I	228822	594	385	249323	624	400
	II	54673	730	75	62084	745	83
	III	205629	4845	42	222878	4711	47
Southwest	I	428596	901	476	495606	883	561
	II	315999	1137	278	291524	1181	247
	III	51823	1467	35	38755	1353	29
Northwest	I	420876	349	1206	442427	359	1232
	II	320160	1026	312	253031	972	260
	III	83720	592	141	84514	485	174

Catch Per Unit Effort (CPUE) worked for different categories of units are presented in Table - 6. In all the regions, there was improvement in the CPUE of units under Category I. However, Category II units, gave a different scenario. Both the regions in the east coast showed slight increment in the CPUE. The increase in the CPUE of units under Category II is attributed to the motorized units operating in the region. The reduction in the CPUE of units under Category II indicated that in the southwest region, it reduced by 31 kg, from 278 to 247, due to the reduced landings of the motorized units. The southwest region also indicated that non-motorized units slowly are getting reduced in number and the catch per unit also declined. However, northwest region indicated improvement in the CPUE of units under Category III.

PELAGIC FISHERIES DIVISION

The Division carried out investigations on the fishery and resource characteristics of commercially important groups such as Sardines, Anchovies, Seerfishes, Tunas and billfishes, Mackerel, Bombay duck and Ribbonfishes under 7 newly formulated projects, and also under the Inter-Divisional Project on the fishery forecasting, collected data on oil sardine, lipid content and various environmental parameters.

Fishery and Resource characteristics of *Sardinella* spp. (PF/RE/1.1)

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The sardine resource on the west coast was mainly exploited by the purse seiners. At Karwar, 240 t of sardines, at an effort input of 2,815 units were landed, which was 665 units higher than last year. At Mangalore, the catch and c/e declined by 37% and 5% respectively. The total catch was 1,811 t at a c/e of 206 kg. The effort input declined by 4,623 units. But the annual c/e of 206 kg was same compared to last year. At Malpe, the catch (3,995 t) and c/e (464 kg) showed an improvement by 356 t and 54 kg respectively. The highest c/e of 1.1 t was at Cochin and the catch amounted to 2,401 t. Sardines formed 10% at Mangalore and Karwar, 23% at Malpe and 87% at Cochin in the purse seiners.

The effort distribution by purse seiners showed that the entire effort was in the 21-40 m depth zone at Karwar. At Mangalore, 70% of total effort in 11-20 m zone realised 94% of the total sardine catch. The catch from 21-40 m zone was poor at Mangalore and Malpe. At the latter centre 0-10m zone was most productive (c/e 1,117 kg) though effort input was only 11% of total yearly effort. About 60% of the effort was in 11-20 m zone realising (2,458 t) 61.5% of the total sardines landed. At Cochin 80% of the effort input in the 21-40 m zone realised 68% of the total sardines by the gear. In the 11-20 m zone only 20% of total effort was expended. The main fishing season was during December, April, October, November and February at Mangalore; and December, November, February and April at Malpe. At Karwar, sardines occurred only in the month of May, October, November, December and January; and at Cochin the peak landings were in April, May, October, November and March. In the purse seines the oil sardine catch declined from 420 t in last year to 104 t in the current year at Karwar and from 1,500t to 1,091 t at Mangalore. But the catch increased from 2,080 t to 2,307 t at Malpe and from 1,094 t to 2,401 t at Cochin.

The sardines have been found to occur in the trawlers at Mangalore, Malpe and Visakhapatnam. The resource formed 0.11% and 0.38% respectively at the former two centres. The catch was 24 t (c/e 0.63 kg) at Mangalore and 53 t (c/e 1.6 kg) at Malpe. At Visakhapatnam 27 t were landed which was higher by 26 t compared to previous year.

In the indigenous gears like *Yendi* at Karwar the catch was only 3 t at a c/e of 3.1 kg. The *Mattabale* at Mangalore and Malpe recorded no sardines, but 156 t of sardines were landed during last year (c/e 147kg). The

Ranibale landed 4.4 t at Malpe. At Cochin the ring seine catch of sardine was 361 t at a c/e of 51 kg. The highest catch (85%) was during April-June, followed by October-December (12%) and January-March (3%). At Tuticorin, the small meshed gillnets landed 646 t of sardines at a c/e of 28 kg constituting 73% of the total catch of the gear. Peak season was during July-September (31.6%), followed by April-June (27.7%) and October-December. At Visakhapatnam, the gillnets landed 94 t (c/e 20 kg), boat seines 7.8 t (c/e 6.7 kg) and shore seines 4.1 t (c/e 28 kg).

Species composition: In the purse seines at Karwar, *Sardinella dayi* (50%), *S. longiceps* (43%) and *S. gibbosa* constituted the fishery. At Malpe and Mangalore, oil sardine formed 57-60% in the purse seines. Other species noticed were *S. gibbosa, S. brachysoma* and *S. fimbriata*. Oil sardine was the dominant species in the trawlers at Mangalore, whereas *S.gibbosa* dominated the catch at Malpe. At Cochin, oil sardine formed 72% in purse seines and 89% in the ring seines. *S. gibbosa* formed the rest. At Visakhapatnam oil sardine contributed to 73% in the trawlers. The gillnet catch at Tuticorin was constituted by lesser sardines and mostly *S. gibbosa* (59%), *S. sirm* (21%) and *S. albella* (11.4%) contributed to the fishery. The boat seine catch at Visakhapatnam was dominated by oil sardine.

Biology: Oil sardine of the size 145-165 mm were noticed in the purse seines at Karwar. Males dominated (52%). Gravid fishes occurred in December and pre-adults in May. At Mangalore oil sardine of 50-195 mm were recorded. The new recruits (50-90 mm) appeared during September, November and December. Pre--adults in the catch formed 46% and most of the adults were in resting stage. At Malpe, oil sardine of 7-155mm were noticed and the purse seine catch was mostly constituted by (97%) pre-adults. Males dominated among adults. The length at first maturity was 150 mm. *S. gibbosa* of the size range 105-170 mm and *S. fimbriata* of 110-165 mm were observed. At Cochin, this species had a size range of 90-200 mm in purse seines and 90-120 mm in the ring seines respectively. Here, the new recruits (90 mm) appeared during November. Males dominated and gravid fishes occurred in May. *S. gibbosa* of 110-175 mm were observed at Cochin and Tuticorin. At the latter centre gravid ones occurred throughout the year with higher percentage during April/May, August and January/February. At Visakhapatnam, oil sardine of 130-195 mm in the trawlers, 35-205 mm in the boat seines and 125-200 mm in the gillnets were observed. The new recruits (35-80 mm) occurred in the boat seines during August.

Fishery and resource characteristics of Anchovies (PF/RE/1.2)

N.S. Radhakrishnan, G.M. Kulkarni, Prathibha Rohit, A.A. Jayaprakash, G.Gopakumar

The total anchovy landings at centres such as Mangalore, Malpe, Cochin and Vizhinjam were estimated to be 3,077 t. Nearly 45% was contributed by the purse seiners followed by trawlers (42%), ring seiners (6.6%) and other traditional gears (6.4%). The centre-wise landings were, 2,210 t at Mangalore and Malpe, 683 t at Cochin and 184 t at Vizhinjam. In all these centres the catch showed a declining trend except at Cochin. The catch decreased by 63% at Mangalore, 74% at Malpe and 38% at

Vizhinjam. At Mangalore, 73% of the catch was from the purse seines at a c/e of 162 kg. The trawlers realised a c/e of 14 kg. At Malpe, the major contribution (83%) was from the trawlers and the rest by the purse seines. At Cochin also, trawlers emerged as the main contributor (69%) followed by the ring seines. At Vizhinjam, 85% of the catch was from the boat seines and 13% from *Netholivala*. The peak season was during August-November at Cochin, April-May and October to January at Mangalore, and during August at Vizhinjam.

In the trawlers, *S. devisi* (53%) was the dominant species at Mangalore and *S. bataviensis* at Malpe. But in the purse seines *S. devisi* dominated at both the centres. At Cochin, in the trawlers *S. devisi* (74%) and in the ring seines *S. macrops* (95%) dominated. At Vizhinjam also *S. devisi* was the dominant species in the boat seines and *Netholivala*.

The length ranges of *S. devisi* was 50-95mm at Mangalore, 60-95 mm at Cochin and 35-104 mm at Vizhinjam. The size range of *S. bataviensis* was 56-115 mm at Mangalore, 70-95 mm at Cochin and 30-109 mm at Vizhinjam. At Mangalore *S. macrops* evinced a sex ratio (male:female) of 2:1, and all the specimens were in developing stage. At Cochin, the sex ratio of *S. bataviensis* was 3:2, and developing stages dominated. In *S.macrops* the ratio was 4:1 and 88% were in the resting stage. At Vizhinjam, *S. devisi* and *S.punctifer* were mostly in partially spent stage. Juveniles of the former species (25-44 mm) occurred in the shore seines in January. At Bombay the *dol* nets landed 280 t of *Coilia dussumieri* at a c/e of 28 kg forming 7% of the catch by the gear. The sex ratio was 1:3.1 and 75% of the females were in the resting stage. The size ranged from 20-190 mm.

Fishery and resource characteristics of Seerfishes (PF/RE/2.1)

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Seerfishes were exploited by trawlers, gillnetters and hooks and lines at Tuticorin; gillnetters and trawlers at Cochin and Veraval; gillnetters at Calicut; and trawlers and purse seiners at Mangalore and Malpe area. The yield during the year was 335 t at Tuticorin, 288 t at Cochin, 308 t at Calicut, 721 t at Mangalore-Malpe area and 1,447 t at Veraval. Compared to the previous year, the landings showed significant increase at Tuticorin (102%), Cochin (100%) and Calicut (54%). The increase was marginal (10%) at Veraval. The Mangalore-Malpe region registered a decline of 33%. The peak season was during July-September at Tuticorin and during September-December on the west coast centres.

The gillnets were employed at all centres and the highest unit operation (32,801) was at Veraval and the lowest at Calicut (6,715). It was the sole gear at Calicut, a major contributor (78%) at Cochin, Mangalore-Malpe (52%) and Veraval (84%). Compared to the previous year the total effort input had decreased at all the centres. A decrease of 32% at Veraval and 2% at Mangalore-Malpe area was recorded.

The c/e of the gillnets was low (9 kg) at Tuticorin, but on the west coast centres it was 39 kg. The yield rate showed improvement except at Mangalore-Malpe area. The increase was 66% at Veraval (from 22 to 37 kg), 69% at Calicut (27 to 46 kg), 124% at Cochin (14 to 31 kg) and 53% at

Tuticorin (6 to 9 kg). At Mangalore- Malpe area the c/e declined by 15 kg compared to last year.

Seerfishes occurred as bye-catches in the trawlers at Veraval, Mangalore-Malpe, Cochin and Tuticorin. The highest production of 299 t was at Mangalore-Malpe and lowest (63 t) at Cochin. But the c/e (6 kg) was highest at Tuticorin and lowest (1.4 kg) at Cochin. The trawlers contributed to 57% of the total seerfish catch at Tuticorin, 22% at Cochin, 41% at Mangalore-Malpe and 16% at Veraval. Except at Veraval, the effort input and c/e have recorded an increase.

At Mangalore-Malpe, the purse seines exploited 44 t of seerfishes as against 350 t during last year. The purse seines contributed to 6% of the seerfish catch at this centre.

The hooks and lines at Tuticorin landed 31 t (c/e 8 kg) of seerfishes forming 6% of the total seerfish catch there.

Species composition: Among the four species of seerfishes, namely *Scomberomorous commerson, S. guttatus, S. lineolatus* and *Acanthocybium solandri*, the first two were of commercial importance at all the centres. The last two species occurred in small numbers at Tuticorin and Veraval. The King seer, *S. commerson* was the only species at Calicut, and the dominant species (94%) at Tuticorin, Cochin (98%) and Mangalore-Malpe (87%). *S. guttatus* dominated the catch at Veraval (63%). In the trawlers *S. commerson* was the principal species at Tuticorin, Cochin and Mangalore-Malpe, whereas *S.guttatus* was found dominant at Veraval. The king seer was the only species in the purse seines at Mangalore and the predominant species (93%) in the hooks and lines at Tuticorin.

Size distribution: In the small meshed gillnet, *Podivalai* at Tuticorin, *S. commerson* of the size 16-76 cm with dominant modes at 28 and 32 cm were observed. In the large meshed gillnets at all centres the length ranged from 14-142 cm with multimodes, except at Cochin where it was unimodal. The fishery was supported by 22-48 cm in the *Podivalai* and 42-60 cm in the *Paruvalai* at Turicorin, 52-66cm at Calicut, 32-66 cm at Mangalore-Malpe and 46-116 cm at Veraval. In the trawlers the length ranged from 16-110 cm at Tuticorin, with multimodes and the fishery was supported by 28 and 58 cm in all the centres. In the hooks and lines (Tuticorin) the size range was 48-136 cm and 58-100 cm size groups supported the fishery. In the gillnets at Veraval, *S.guttatus* of 16-62 cm with multimodes at 22, 36 and 42 cm; and at Mangalore-Malpe 30-52 cm with modes at 36 and 44 cm were noticed. At both these centres 36-48 cm size groups supported the fishery. *S.guttatus* occurring in the trawlers at Veraval had a size range of 22-60 cm and at Mangalore–Malpe 26-52 cm.

Fishery and resource characteristics of tunas and billfishes (PF/RE/2.2)

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The resource characteristics of tunas and billfishes were monitored from Veraval, Mangalore, Malpe, Calicut, Cochin, Vizhinjam and Minicoy. The total effort expended by different gears were: gillnets 91.7%, purse seines 7%, hooks and lines 0.5% and pole and line 0.8%. Of the total tuna catch 58% was from drift gillnetters, 29.5% from purse seiners, 6.9% from hooks and lines, 3.6% from

pole and line and 2% from troll lines. The c/e recorded in each gear was 57 kg, 183 kg, 6 kg, 192 kg and 33 kg respectively.

At Veraval, 6,983 t of tunas and 155t of billfishes were landed by the drift gillnets. Tunas constituted 24% with a c/e of 50 kg. The effort and catch declined by 28% and 52% respectively compared to last year, mostly due to unfavourable environmental conditions and also the fuel shortage affected the long duration trips of *Jadajal* (Drift gill net). The *Zinajal* (coastal gillnetters) also were in operation.

The longtail tuna *(Thunnus tonggol)* constituted 55%, yellowfin tuna *(T. albacares)* 20%, little tuna *(Euthynnus affinis)* 14% and frigate tuna *(Auxis thazard)* the rest. The size ranges of the above tunas were 32-92 cm (wt.5-20 kg) with mode at 68-70 cm, 66-136 cm with mode at 84-88 cm, 18-76 cm with mode at 36 cm and 16-50 cm with mode at 32-34 cm respectively. Juveniles of little tuna (18-20 cm) and frigate tuna (16-18 cm) appeared during October-November, February-March and May. The diet consisted of small squids, planktonic crustaceans and juvenile fishes. Females were dominant in longtail tunas.

About 5-6 processing plants were exporting longtail and yellowfin tunas to countries like USA, Japan, Turkey and Hong Kong in the headless frozen form. The retail price per kg was Rs. 35-50. Among billfishes *Istiophorus platypterus* (82%), *Makaira indica* (10%) and *Xiphias gladius* (8%) were noticed and formed 155 t.

At Mangalore-Malpe, the purse seiners landed 4,119 t (c/e 237 kg) and gillnetters 332 t (c/e 36 kg) of tunas and billfishes registering an increase of 7-10% in the catch and 12% in the catch rate compared to last year. The purse seine catch was composed of little tuna (71%), frigate tuna (19%) and the rest by bullet tunas *(A. rochei)*. In the gillnets also the above species dominated. In addition yellowfin tuna, longtail tuna and the oriental bonito *(Sarda orientalis)* were also encountered. The fishery was supported by one and two year old little tunas and one year old frigate tunas.

At Calicut, the gillnets landed 152 t of tunas during April-September recording a two fold increase over the corresponding period last year. Mostly the little tunas and frigate tunas supported the fishery.

At Cochin, the purse seines exploited 422 t and gillnets 786 t of tunas, each gear recorded an increase of 385 t and 212 t respectively when compared to last year. Tunas formed 69% in the gillnet catch with a peak season during July to October. The little tunas dominated the fishery, mostly supported by the one and two year old fishes. In the purse seines, nearly 97% (408 t) of the tuna catch was landed during September and little tuna constituted the fishery.

At Vizhinjam, 1,918 t of tunas were exploited of which 54% (1,026 t) was by hooks and lines and the rest (892 t) by drift gillnetters. The motorised units operating the above two gears contributed to 48% (492 t) and 42% (375 t) respectively. The peak catch was in May and August. In the drift gillnets operated by motorised craft *E.affinis* (34%), *S.orientalis* (31%), *A.thazard* (21%), and *A.rochei* (14%) formed the catch. Among billfishes, *I.platypterus* constituted 67%. *E.affinis* occurred in the size range of 18-60 cm and the fishery was supported by one and two year old fishes. *A.rochei*

had a size range of 16-30 cm, *A. thazard* 20-50cm, *S.orientalis* 12-52 cm and *T. albacares* 38-156 cm.

At Tuticorin, 1,792 t of tunas were landed, the catch being 12.8 t (c/e 2 kg) by *Podivalai*, 1,770 t (c/e 250 kg) by *Paruvalai* and 8.7 t (c/e 2 kg) by hooks and lines. In the *Podivalai*, *E. affinis* (65%) was the dominant species followed by *A.thazard*, while in *Paruvalai* the latter species dominated. Males of *E.affinis* had a size range of 34-74 cm and females 28-76 cm. *A. thazard* had a size range of 30-48 cm for both males and females.

At Minicoy, out of 595 t of tunas exploited, the pole and line contributed 563t (c/e 192 kg) and troll lines 32 t (c/e 34 kg). Compared to last year the pole and line catch increased by 80 t and that of troll lines by 2 t. In the pole and lines, the highest catch of 182 t was in March, but the highest c/e of 248 kg was in February. The skipjack tuna, *Katsuwonus pelamis* (87%) dominated followed by *T. albacares* in pole and lines but they occurred in equal proportions in troll lines. Skipjack occurred in the length range of 42-74 cm and 48-58 cm size group supported the fishery. Stages VI and VII were noticed, the latter stage dominated in February and March indicating spawning during the period.

About 13 t of live-baits were used in the fishery during the year. *Spratelloides* spp. contributed 42%, followed by Apogonids (16%) and Caesionids (10%). Collection per boat varied from 6-16 kg. *Gymnocaesio gymnopterus* was the dominant species among caesionids. Food items of skipjack consisted of *Spratelloides* spp., Apogonids, caesionids and squids.

Fishery and resource characteristics of mackerel (PF/RE/2.3)

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On the west coast, mackerel *(Rastrelliger kanagurta)* was exploited mainly by purse seiners, trawlers and artisanal gears. Except at Cochin, the mackerel landings along the west coast showed a declining trend. The purse seine catch at different centres were: Cochin 801 t (+65 t), Mangalore 2,635t (-286 t), Malpe 3,345 t (-2886 t) and Karwar 391 t (-121 t). At Mangalore, the trawlers landed 101 t, Malpe 233 t and Cochin 715t. The highest c/e of 16 kg was at Cochin and lowest 3 kg was at Mangalore. Mackerel formed 0.5 to 2% in the trawlers. The gillnets landed 23 t at Cochin, 25 t at Calicut, 10t at Mangalore and 3 t and Malpe. Mackerel constituted 15-20% of the purse seine catch. At Cochin and Karwar, an increase in effort input by 861 and 665 units have been observed. The c/e declined from 566 kg during last year to 371 kg at Cochin, 229 kg to 139kg at Karwar, 702 kg to 298 kg at Malpe, but evinced an increase from 175 kg to 298 kg at Mangalore. At Mangalore, 72% of the effort was in the 11-20 m depth zone, but 28% of the total effort in 21-40 m depth zone realised 87% of the total catch. At Malpe 63% of the mackerel catch was from 11-20 m zone spending 57% of the total effort. The remaining catch was from the 21-40 m zone. Though mackerel occurred throughout the year, the peak catch was during September at all the centres. At Calicut, the mackerel (25 t) fishery was a failure.

On the east coast, there was significant increase in mackerel landings at all centres. At Mandapam 4,739 t of mackerel was landed by trawlers and gillnetters with a peak period in October. At Kakinada, 789 t at a c/e of 15kg by the trawlers and 102 t (c/e 111 kg) by the gillnetters were landed. At Visakhapatnam the catch of mackerel by various gears were: trawlers 60 t (c/e 4.5 kg), silknet 45 t (c/e 6 kg), gillnet 4 t (c/e 0.7 kg), boat seines 2 t (c/e 1.3 kg) and shore seines 1 t (c/e 3 kg). At Kakinada *R.faughni* (180-250 mm) started appearing in the trawlers by January and formed 1% of the total catch. The species has been found to occur at Visakhaptnam also.

The new recruits of mackerel *(R. kanagurta)*, 140 mm and above appeared during August at Karwar, 90 mm and 45 mm during May and March at Mangalore, and 60 mm during May at Malpe. In the trawlers, at Malpe 70 mm and above were recorded during November-December, 130 mm at Cochin during April and 85-149 mm at Kakinada during April, October and January. At Visakhapatnam young mackerel (65 mm) occurred in the boat seines and shore seines during November-December.

At Mandapam, the size ranged from 150-309 mm, at Kakinada 85-259 mm and at Visakhapatnam 165-229 mm. Mackerel from purse seines on the west coast had a size range of 140-270 mm at Karwar, 45-295 mm at Mangalore and 60-275 mm at Malpe. In the gillnets and purse seines at Cochin the size ranged from 160-260 mm. Mackerel of the size 135-275 mm were recorded in the trawlers at Malpe, and 135-260 mm at Cochin. At Calicut the size ranged from 220-264 mm. The size distribution was unimodal or bimodal along the east coast but bimodal along the west coast.

Gravid stage occurred during May and January-February at Visakhapatnam and Kakinada. At Cochin, gravid fishes occurred during April, September-October, February and March in the purse seines; and April, August, October and November in the gillnets. At Mangalore gravid fishes were noticed during December to March in the trawlers.

At Visakhapatnam, sex ratio was equal in all the gears. Nearly 96% of the specimens from trawlers were fully spent, whereas gravid or partially spent ones constituted 60% in the gillnets. Feeding condition ranged between $\frac{1}{2}$ and full, and main food item was phytoplankton. At Kakinada gravid fishes were noticed during January to April. Nearly 65% of the fish were with empty stomach and 28% were well fed.

Fishery and resource characteristics of Bombay duck (PF/RE/3)

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Saurashtra

In Saurashtra, the total fish catch by the *dol* nets was 57, 649 t (c/haul 179 kg) at an estimated effort of 322,697 hauls. Bombay duck *Harpodon nehereus*, constituted 62% and the estimated catch was 35,825 t at a c/haul of 111 kg. The *dol* net operations at Rajpara yielded 21,547 t of Bombay duck followed by 13,409 t at Nawabander and 869 t at Ghoghala and the c/haul was 133 kg, 92 kg and 56 kg respectively. The fishery was supported by 30-315 mm size groups.

An estimated 187 t of young ones (1.4%) of Bombay duck were exploited at Nawaban-

der, 177 t (0.8%) at Rajpara and 107 t (1.2%) at Ghoghala. At Ghoghala the males and at Rajpara females dominated the fishery. Mostly developing stages constituted 53-57% and mature fish formed 4-5%.

Maharashtra

The estimated catch of Bombay duck at Arnala was 1,845 t at a c/e of 208 kg and formed 46% of the *dol* net catch. The catch and c/e were high during September-October. The size ranged from 44-352 mm. Young ones of 30-120 mm constituted 27% of the catch. Males dominated and most of the females were in resting and developing stage. Gravid stage was rare.

Fishery and resource characteristics of Ribbonfishes (PF/RE/4)

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The trawlers at Veraval, Bombay (New Ferry Wharf), Mangalore, Malpe and Kakinada together landed 24,000 t of ribbonfishes and constituted 3 to 15% of the total catch of the gear. The highest catch of 12,346 t (more than 50%) was at Veraval, followed by 6,501 t at Bombay. But the c/e (233 kg) was highest at the latter centre. At Mangalore, Malpe and Kakinada, the landings were 2,421 t, 315 t and 2,226 t respectively. Compared to the previous year, the catch increased by 4% at Veraval, 42% at Bombay and 106% at Mangalore. But a decline in the catch was recorded at Malpe (75%) and Kakinada (10%). Ribbonfishes formed 3 to 15% at these two centres.

The gillnets, at Veraval, Kotada-Madhvad and Vanakbara in Veraval, Uppada in Kakinada and at Mangalore-Malpe exploited 687 t of ribbonfishes. The highest catch (302 t) was at Kotada-Madhvad and the minimum (3 t) at Malpe. But highest c/e was at Mangalore (14.4 kg). Ribbonfishes constituted 1 to 25% in gillnets and compared to last year an increase of 56% was noticed at Kotada-Madhvad, 35% at Vanakbara and 8124% at Mangalore. But at Veraval, the gillnet catch of ribbonfishes declined by 38%.

In the purse seines at Mangalore and Malpe ribbonfishes formed 49 t and 66 t respectively, forming 0.3 and 0.4% of total catch. Compared to last year a tremendous increase in catch by 117% at Mangalore and 5927% at Malpe was recorded.

Total ribbonfish catch at Vizhinjam was 595 t. The peak landings were in August-September. Nearly 81% of the catch came from boat seines (483 t, c/e 46 kg). The drift gillnets contributed 2 t and hooks and lines 110 t.

Trichiurus lepturus was the dominant species in all these centres constituting 96-100%. In the trawlers the size range of *T. lepturus* was 20-96 cm at Veraval, 40-135 cm at Bombay, 14-103 cm at Mangalore, 26-106 cm at Malpe and 18-148 cm at Kakinada. The longest recorded specimen of 148 cm was reported from Kakinada. The smallest mode noticed was at 20 cm from Mangalore and the largest at 115 cm from Bombay. In the gillnets the length range was 34-92 cm at Veraval, 36-92 cm at Kotada-Madhvad, 34-92 cm at Vanakbara and 26-102 cm at Uppada.

Sex ratio showed the dominance of females at Veraval, Mangalore and Vizhinjam, while males dominated at Bombay and Kakinada.

The growth parameters of *T. lepturus* at Mangalore were estimated as, $L\infty =$

123.1cm, K = 0.4506 and t = -0.16913. The estimated MSY for trawl was 2,081 t and the present yield of 2,736 t is far above the MSY and hence a reduction of effort by 30% is recommended at this centre.

At Madras, an estimated 2,306 t of *T. lepturus* was exploited by 40,798 units of trawlers. The catch declined by 46% when compared to last year. On an average ribbonfishes formed 8% of trawl catch. Nearly 50% of the production was during October-December, recording a maximum c/e of 182kg in November and a minimum of 8 kg in March. The size ranged from 25-84 cm with mode at 44 cm.

Forecasting of the Oil sardine, Mackerel and Bombay duck in the fishing grounds (CMFRI/IDP/1)

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The data on the catch trends and biological features of oil sardine and mackerel for the years 1984-88 have been compiled for correlating with the variations in the environmental parameters in the fishing grounds so as to evolve a forecasting system. The lipid content of oil sardine and mackerel, both size wise and season wise have been worked out to correlate with the spawning.

RESOURCES

BOMBAY DUCK

The Bombay duck *Harpodon nehereus* accounted for 1,27,000 t constituting 10.6% of the pelagic resources, showed a decline by 9,000 t.

RIBBONFISH FOR EXPORT

The ribbonfish *Trichiurus lepturus* in the frozen form is picking up in the export market in recent years.

YELLOWFIN TUNA TAKEN BY LONGLINES

23 Thaiwanese chartered vessels landed yellowfin tuna (4,349 t), bigeye tuna (139 t), billfishes (655 t) and pelagic sharks (516 t) from the EEZ of India during 1992.

RESOURCES

A record catch of 15,000 t of 'karikkadi' *(Parapenaeopsis stylifera)* was landed at Sakthikulangara (Quilon) by trawlers. Nearly 72% of the total catch was landed during the monsoon season.

A variety of gastropod shells which form part of the non-edible biota landed by trawlers are utilised by the cement industry. The opercula of some species are used in the incense industry.

DEMERSAL FISHERIES DIVISION

During the year the capture fisheries projects were recast, in order to assess the effect of present exploitation on the important resources as well as to suggest suitable management and regulatory measures for optimum production. All the Project Leaders and the Associates were given suitable guidelines, to collect and analyse data which will be essential for arriving at tangible results. Attention was also drawn to the need for collecting factual data on the quantum of breeders and juveniles caught and the quantity of non-edible benthic biota removed as a result of trawling. The vital needs to record the data on the environmental parameters in the locality of fishing operations as well as to correlate the hydrological parameters with the availability and abundance of various resources were also given special emphasis.

There were seven capture fisheries projects and one culture project, as reviewed now:-

Studies on the resources and biology of elasmobranchs (DF/RE/1)

P. Devadoss, M. Feroz Khan, Grace Mathew, K.M.S. Ameer Hamsa

At Bombay, the estimated catch during the year was 4,112 t all by trawlers (c/e 136 kg) as against 2,444 t during the previous year. The trawlers have ventured upto a distance of 30 km from the coast and upto a depth of 70 m. The major species reported were *Scoliodon laticaudus, Rhynchobatus djiddensis* and *Dasyatis zugei*. *S.laticaudus* ranged in length from 14 – 64 cm for males and 16 – 64 cm for females, with mean sizes at 36 and 37 cm respectively. The population has fed upon *Nemipterus* spp., *Harpodon nehereus, Acetes* spp. and *Loligo* spp.

At Calicut, the total production was 525t (92 t last year) mostly by trawl nets and to a minor extent by long lines and drift gillnets. The long lines have operated at distances of 100-150 km from the coast at depths of 90-100 m, the trawlers upto 50 km at a depth of upto 50 m and drift gillnets at 15-25 km at a depth of about 25 m.

At Cochin, the total production was 173 t by four gears, namely trawlers contributing to the bulk, followed by gillnets long lines and hooks and lines. Compared to the previous year, there was a reduction of about 34% in the landings. The distance of trawling grounds was 15-25 km and the depth ranged from 40-60 m. *Carcharhinus amboinensis, C. limbatus, C. melanopterus* and *Rhizoprionodon acutus* have contributed to the catches, in the length ranges of 180-200 cm, 150-190 cm, 60-100 cm and 40-100 cm respectively.

The production at Tuticorin during the year was 751 t, as against only 297 t during 1991-92, by trawlers (c/e 12 kg), drift gillnets (c/e 33 kg) and bottom set gillnets (c/e 76 kg) at distances and depths of 15-30 km and 30-80 m for the trawlers, 10-20 km and 30-100 m for drift gill nets and 5-10 km and 10-20m depths for bottom set gillnets. *C.sorrah*, of the size range 58-102 cm with the mode at 72-76 cm was the dominant species. Sex ratio was equal. An estimated non-edible biota of 187 t was removed by trawling during the year.

There was an increase in production at Madras also, from 528 t in 1991-92 to 727 t during the current year. The trawlers have contributed to 619 t, drift gill nets 52 t and bottom set gillnets 57 t. The trawlers have operated at a distance of 10-20 km off Madras, at a depth of 20-50 m and have removed an estimated non-edible biota of 1,122 t during the year. Drift gillnetting was conducted at a distance of 10-30 km at depths of 20-60 m. *D. jenkinsii, D. uarnak, D. sephan* and *Aetobatus narinari* were the major species available and the length ranges of the respective species were 50-105 cm with mode at 75 cm; 90-145 cm with mode at 120 cm; 85-120 cm with mode at 90 cm; and 100-160 cm with mode at 140 cm. Sex ratio was almost equal among the species.

Studies on the biology and fisheries of perches (DF/RE/2)

S. Lazarus, Grace Mathew, K.M.S. Ameer Hamsa, P. Livingston

The estimated production of perches at various centres were: Mundrayarchatram 3,109 t, Tuticorin 2, 203 t and Kilakarai 613 t on the south east coast; Cochin 501 t, Vizhinjam 423 t and Muttom 273 t on the west coast. The catches were recorded throughout the year, with peak during December-March period. Hooks and line was the major gear and about 70-90% of the perch catch was landed by the gear, at Cochin, Vizhinjam, Tuticorin and Kilakarai.

Epinephelus diacanthus occurred throughout the year and species such as *E.bleekeri, E. chlorostigma, E. tauvina, Pristipomoides typus* etc were seasonal in their appearance in the line catches. Most of the species have an export market.

Studies on the biology and resource management of catfishes (DF/RE/3)

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During the year 1992-93, catfish landings showed considerable decline at all centres except Bombay. The species *Tachysurus dussumieri* was fairly abundant only along the northwest coast, whereas *T. thalassinus* occurred all along, with particular abundance in the south east and southwest coasts. Another important observation was that *T. caelatus* and *Osteogeniosus militaris* occurred in appreciable quantities only along north west and Mandapam regions. The shoaling species such as *T. tenuispinis, T. dussumieri* and *T. serratus* showed less abundance, compared to previous year.

In Bombay, the annual catfish production was 2, 948 t, contributed by mechanised trawlers at a c/e of 97 kg and showed an increase of 7% over last year. The fishing depth was 20-70 m. Peak catch was during September. More than 8 species appeared in the fishery, out of which *T. dussumieri* accounted for 37.0% followed by *O. militaris* (24%) and *T. thalassinus* (18%). The length range of *T. thalassinus* was 12-66 cm while that of *O. militaris* and *T. caelatus* were 14-47 cm. *O. militaris* preferred crustacean diet while *T. caelatus* a piscivorous diet.

At Karwar, the catfishes were chiefly landed by purse seines and the production by the gear was about 10 t at a c/e of 3 kg. The entire catch was composed of *T.serratus*. The fishing depth was 30-35 m.

In Mangalore, the catfish landing was only about 37 t showing a decline of 70%

over last year. The trawlers have contributed to 83.0%, drift net 12% and purse seine 6%. Purse seine production was only during November and constituted 2 t of *T. thalassinus*. The component species of trawl nets which operated in depths of 6-46 m, were *T. thalassinus, T. dussumieri* and *T. serratus*. The major species appearing in the drift gillnetters from a fishing depth of 30-50 m were: *T. thalassinus* 92% and *T. serratus* 8%. The catfish production at Malpe also showed a declining trend and the annual catch was only 24 t. The drift gillnetters have landed 4 t (c/e 1.2 kg) and trawlers 20 t (c/e 0.1 kg). *T. serratus* (83%) and *T. thalassinus* (15%) dominated the gillnet landings, while the trawlers caught *T. thalassinus* (55%), *T. tenuispinis* (21%) and *T. dussumieri* (14%). The size range of *T. dussumieri* and *T. thalassinus* were 12-57 cm and 14-24 cm respectively.

At Calicut, the catfish landing was 15 t contributed by drift gillnets (7.5 t), long lines (5.8 t) and ring nets (1.3 t). *T. serratus, T. thalassinus* and *T.dussumieri* have dominated the drift net catch whereas both ring nets and hooks and line have brought *T. thalassinus*. The depth of operation for gillnetters was 25-90 m, 90-100 m for long lines, and 15-50 m for ring nets.

At Cochin, the catfish production showed a drastic decline from 402 t in 1991-92 to a meagre 29 t in 1992-93. About 42% of this catch was realised by purse seines, 34% by drift nets and 24% by trawl nets. The fishing depth ranged from 30-60 m for trawlers and 30-70 m for gillnetters. The production by trawl nets have declined drastically. The catch rate was 0.15 kg in trawl nets and 1.3 kg in drift nets. The entire trawl catch was composed of *T. thalassinus* and that of the purse seiners consisted of *T. serratus*. *T. serratus* was the dominant species in drift nets. The size range of *T. serratus* was 92-112 cm and that of *T. thalassinus* was 46-78 cm. Ripe females of both species were encountered during post monsoon months.

At Mandapam, the trawlers landed 139 t at Rameswaram at a c/e of 1.9 kg; and 15.6 t from Pamban at a c/e of 1 kg. The production showed a declining trend. Catches were high during July and November. Pair trawling was low during the year. At Rameswarm (Palk Bay) *T. caelatus, T. thalassinus* (about 26% both) were the dominant species in trawl nets. At Pamban (Gulf of Mannar) *T. thalassinus* (39%) was the major species. Drift gillnetters of Pamban have landed 8.1 t of catfishes composed of *T. dussumieri* (30%), *T. talassinus* (14%), *T. serratus* (12%) etc. The length range of *T. thalassinus* and *T. caelatus* were 8-60 cm and 20-57 cm respectively. The peak spawning season for *T. caelatus* was during October.

At Madras, only hooks and lines have landed 12 t (c/e 5.4 kg) of catfishes which is 8% of the total catch of the gear. The peak landings were in March and May. The catch was composed of *T. dussumieri*.

At Visakhapatnam, the trawler catch (depth 20-70 m) was 27 t showing a 50% decline compared to last year. There was considerable decrease in effort also. *T. thalassinus* was the major species followed by *T. tenuispinis* and *T. dussumieri*. The length of *T. thalassinus* ranged from 12-42 cm.

Stock assessment of threadfin breams and silverbellies (DF/RE/4)

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Threadfin breams

At Bombay the production was 4,299 t at a c/e of 142 kg, both of which were lesser than the previous year, the former being about 27%. *Nemipterus japonicus* has ranged in length from 10 – 30 cm, with the mean at 18.4 cm, the catch being dominated by 1.5 year old fish. Most of the specimens were in maturing stages and they were feeding upon crustaceans. The total stock, standing stock and the yield of the species at Bombay were estimated as 3,047 t, 810 t and 1,645t respectively, with the MSY calculated as 1,451 t. The studies during the year have indicated that by increasing the cod-end mesh size, there is scope for decreasing the fishing mortality of juveniles for promoting growth and for increasing the catch; and also that there is little scope for further increasing the fishing intensity. *N. mesoprion* has ranged in length from 8 to 24 cm, with the mean at 17.1 cm and the catch being dominated by 1.5 year old fish. Most of the specimens were maturing and were mostly feeding upon crustaceans. The total stock, standing stock and the MSY for this species at Bombay during the year were: 3,301 t, 1299 t and 816 t respectively. The studies have indicated that by increasing the cod-end mesh size there is much scope for increasing the production; and that the fishing intensity for it can even be doubled from the present level.

The production at Mangalore and Malpe was 2,012 t, showing a marginal increase over the previous year. *N. japonicus* has dominated in both the Centres. Gravid fishes occurred during November-January and young ones during December-March. The size ranged from 6 – 27 cm. Most specimens were in maturing condition and females dominated.

At Cochin, 8,087 t have been caught at a c/e of 178 kg showing an increase of 69% over previous year. The monsoon months of June-September have landed more than 93% of the total production. *N. mesoprion* formed 99%, in length ranging from 6-23 cm, with modes at 9 cm, 14 cm, and 19 cm. About 53% of the population were mature, with gravid specimens forming 13% during May-September.

At Tuticorin, the estimated production was 1,142 t and *N. delagoe* formed 91% of the threadfin bream component. They ranged in length from 14 – 30 cm, with the mode at 18 cm. Most of the specimens were in maturing stages and males dominated.

At Madras, the catch and c/e have consistently increased over the past 10 years recording a three fold increase during the current year when compared to 1982. Due to the introduction of vessels larger than 42' OAL, overnight fishing upto 4 days has become possible. Nearly 40% of the catch in Madras was from multiday fishing. Also, species composition of threadfin breams has changed considerably. For instance, *N. mesoprion* which formed only 18% during 1982, currently constituted 47%. Changes in the areas as well as depth of fishing operations may be the cause for such a change. The total production during 1992-93 was 3,490 t, of which about 30% was constituted

by *N. japonicus* and 47% by *N. mesoprion*. The former has ranged in length from 8 – 26 cm, with the mode at 12 cm and mean at 14.1 cm. The sex ratio M:F was 1:1.7; maturity was in early stages and it was feeding upon fishes and crustaceans. *N. mesoprion* has ranged from 8 – 22 cm, with modes at 11 and 15 cm, mean at 13.4 cm, sex ratio M:F was 1:1.1 with maturity in early conditions. Major food component was crustaceans.

At Kakinada, the trawlers (code end mesh 13-26 mm) operating at 60-70 m depth landed 570 t of threadfin breams at a c/e of 11 kg. The resource formed 2% of total catch. Compared to last year the catch increased by 35%. The fishery was constituted by one year old size groups of *N. mesoprion* (70%) and *N.japonicus* (22%). The peak catch of the former species was during September, December and March and that of the latter during May, September and January.

At Visakhaptnam, the annual production (811 t) has increased by 2.7 times when compared to previous year, due to heavy landings of *N. mesoprion*, which formed 96% of the catches. It ranged in length from 4 – 21 cm, with modes at 6 and 14 cm, M:F ratio was 4:1 and was mostly in maturing stages. The food consisted of crustaceans. Gravid females occurred during February-May and juveniles during June-September. *N. japonicus* formed 3% and were in the length range of 4-25 cm with mode at 9 cm. Sex ratio M:F was 1:3 and most of them were in maturing and gravid stages. The food composed of crustaceans.

Silverbellies

At Tuticorin, the estimated annual production was 2,567 t and the group formed more than 17% of trawl catches. During June and July maximum landings were recorded. *Leiognathus dussumieri* has formed more than 20%, with length in the ranges of 3 to 15 cm and mode at 10 cm. *Secutor insidiator* has contributed to 18% and *Gazza minuta* 17%.

At Madras, the estimated annual production was 4,721 t forming 17% of trawl landings. *L.bindus* formed 36% of the catches, with length in the range of 8-12 cm, followed by *S. insidiator* forming 26% and in the range of 9-11 cm.

At Kakinada, 680 t of silverbellies were landed by trawlers forming 2.5% of the total catch. Though the effort input has increased, the catch declined by 5%. Out of eleven species observed, *Leiognathus bindus* (36%), *L. splendens* (22%) and *Secutor insidiator* (19%) contributed to the fishery. The size range of the above species were 20-124 mm, 35-139 mm and 40-119 mm respectively.

Stock assessment of croakers (DF/RE/5)

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At Bombay the total catch by trawlers was 7,113 t at a c/e of 235 kg, both the production and abundance having gone up by 24% and 23% respectively. The mean sizes of *Johnieops vogleri, Otolithoides cuvieri* and *J. sina* have increased; but that of *J. macrorhynus* has recorded a decline. *J. sina* has declined in production and was replaced by *Sciaena glaucus;* but, the three species *J. macrorhynus, O. cuvieri* and *J.vogleri* altogether have contributed to 65%. The mortality, yield and stock parameters estimated have revealed that the exploitation ratio was

high for *J. macrorhynus*. Mature *J. sina* females were observed during November-January.

At Karwar, total catch of *O. cuvieri* by trawlers was 12.4 t, at a c/e of 1.6 kg and that of *Johnieops coitor* 11.2 t at a c/e of 1.5 kg.

At Calicut, Puthiappa landing centre, 1,198 t of sciaenids were landed by trawlers, operating at about 15-50 km distance and at 25-30 m depth with catch per boat of 51.2 kg. The mainstay of the production was made up of *Johnieops aneus, J. sina, Otolithes ruber, Johnius belengeri, J. carutta* and *Kathala axillaris*. *J. sina* has ranged in length from 8 - 14 cm, *J. aneus* from 8-12 cm and *O. cuvieri* from 12 - 21 cm. Mature fishes were dominant in the case of *J.sina*. At Vellayil centre about 24 t were landed by ring seines at a c/e of 9.5 kg and *J. sina* has dominated to an extent of 56%.

At Cochin Fisheries Harbour, the total production by trawlers was 421 t at a c/e of 9.3 kg. *J. sina* has contributed to an extent of 74%, followed by *O.ruber*. *J. sina* ranged in length from 5-18 cm and *O.ruber* from 8-27 cm. Females of maturity stages I-III were available in the catches.

In the east coast, at Tuticorin, the annual production by trawlers was 160 t (c/e 5.1kg). *O. ruber, J.maculatus* and *J. dussumieri* were the dominant species. *J. maculatus* ranged in length from 12-24 cm, while *O. ruber* from 17-28 cm, with dominant modes at 18 and 27 cm respectively. In both the species, maturity stages II and III have dominated. *J. sina* was feeding upon *Stolephorus, Leiognathus*, juvenile fishes and shrimps, while *O. ruber* was feeding mostly upon crustaceans.

Although the effort by trawlers at Madras during the year has gone up by 5% when compared to last year, both the annual production and the c/e for sciaenids have declined by 14% and 18% respectively. *O. ruber* was the major species (35%), followed by *J. carutta* (21%), *Pseudosciaena aneus* (13%) and others like *J. dussumieri, Nibea maculata* and *J. sina* formed the rest. *O.ruber* has ranged in length from 9-23 cm, while *K. axillaris* from 9-15 cm. Juvenile recruitment was observed during April-November period. Females have predominated in both the species. In the case of *O. ruber* a decline in the mean size by 27 mm was recorded. Fishes and crustaceans formed the bulk of the stomach contents.

At Visakhapatnam, the total annual production was 295 t, which although was slightly lesser than the production of previous year (by 30 t), has shown a marginal increase in abundance. *J. carutta* has dominated the catches (25%) followed by *N. maculata* 19%), *K. axillaris* (17%), *J. dussumieri* (12%), etc. *J. carutta* has ranged in length from 7-22cm, with modes at 9 and 14 cm; *N. maculata* from 5-23 cm, with modes at 9 and 13 cm; and *K. axillaris* from 5-18 cm, with modes at 9 and 14 cm. In both *K. axillaris* and *N. maculata*, females were dominant. Gravid females occurred in February-March and May.

At Kakinada, 2,612 t of croakers were landed by trawlers at a c/e of 51 kg which formed 9.4% of the total catch. The catch and effort increased by 5.5% and 20% compared to previous year. Out of 18 species that occurred, *N. maculata* (18%), *J. carutta* (11%), *P. diacanthus* (10%), *J. macrorhynus* (8%), *A. nibe* and few others constituted the fishery. The length ranged from 110-278 mm in

A. nibe and 60-259 mm in *N. maculata*. The von Bertalanffy growth parameters of the latter species were L_∞ = 135 mm, K=0.61 per year and t_0 = –0.07 year. The mortality rates are estimated as Z = 2.93, M = 1.26 or 1.15 and F = 1.6 or 1.78. The Lc is 140 mm. The yield per recruit analysis showed that there is scope for increasing the effort by 120% to reach the MSY, however, the increase in yield at this increased level of effort will only be about 5% and therefore effort increase cannot be recommended.

Biology and resource characteristics of lizard fishes, threadfins and flatheads (DF/RE/6)

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The maximum production of lizard fishes during the year was at Madras, with 2,238 t (c/e 55 kg) by trawlers, followed by Bombay with 1,890 t (c/e 62 kg), Cochin with 676 t (c/e 15 kg), Calicut with 371 t(c/e 16 kg) and Tuticorin with 328 t (c/e 11 kg) and marginal catches (2.4 kg) by drift nets. The seasons of abundance was September at Bombay and Tuticorin, June to September at Cochin and December at Calicut. The depth of operation of trawlers ranged from 20-70m at Bombay, 40-90 m at Cochin and 50-70m at Tuticorin; while that of drift gillnetters at about 15 m depth.

Saurida tumbil was the dominant species at Bombay and Tuticorin, while *S. undosquamis* was caught more at Madras, Cochin and Calicut. *S. tumbil* has ranged in length from 10-48 cm at Bombay and 15-42 cm at Cochin; while *S. undosquamis* has varied from 10-25 cm at Bombay, 16-23 cm at Calicut and 12-35 cm at Cochin. Immature specimens of the latter species has formed 20% of the catches during August at Cochin and 27% in Madras. Females of *S. tumbil* out numbered the males at Bombay and of *S. undosquamis* at Cochin; while males of the latter were more than females in Calicut and Madras. All the maturity stages were available during the year; and in January-March juveniles have out numbered the adults. Both the species were feeding upon juvenile fishes.

At Tuticorin, about 102 t (c/e 3.3 kg) of threadfins were caught by trawlers and about 2 t in drift nets (c/e 0.4 kg). *Polynemus macrostoma* was the dominant species followed by *P. plebius*. At Calicut and Cochin polynemids have not formed a fishery.

At Cochin, 54 t of flatheads were caught at a c/e of 4.5 kg. *Platycephalus scaber* was the major species at Calicut and *P. maculipinna* at Cochin.

Biology and fishery of flatfishes, goatfishes and whitefishes (DF/RE/7)

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Flatfishes

At Mangalore, the annual production of *Cynoglossus macrostomus* was 2,247 t, registering an increase of 6.6% over the previous year, most of the production being by trawl nets and about 30 t by purse seines. The distance of fishing grounds was 5 to 30 km at depths of 5-30 m by trawl nets and 6-20 km by purse seines at depths of 6-28 m. The c/e by trawlers decreased by 20% while that of purse seines increased by 18% over the previous year. The size ranged from 6-18 cm,

with modes at 9 and 12 cm and mean length at 12.3 cm. The sex ratio was 16 males: 9 females, and III & IV stages dominated. An estimated 200 t of non-edible biota was removed during the year.

At Calicut, the annual production of the same species was 667 t which evinced an alarming decline of 1,160 t compared to previous year (1,827 t). The c/e has also fallen to 28 kg from 65 kg. About 7 t was by Disco nets while a vast majority of the production was landed by trawlers which were operating between 15 and 50 km distance (depth 25-60 m). The size ranged from 7-15 cm, with the mode at 10 cm and mean at 11cm. Vast majority (40%) were indeterminates; and sex ratio was 23 females: 37 males in gonadial maturity of I-IV, with stage III dominating.

At Cochin, 183 t of *C.macrostomus* and 13 t of *Pseudorhombus javanicus* were landed during the year, the former species showed a drastic decline by 170 t compared to 1991-92. The area of operation was between 9 and 95 km at depths upto 150 m. *C. macrostomus* ranged in length from 7-15 cm, with the mode at 11 cm, sex ratio was 3 male: 2 females. All stages were noticed but stage I &II dominated. *P. javanicus* had a length range of 17-24 cm, with the mode at 19 cm; sex ratio was 4 males: 1 female; gonadial maturity stages ranged from II to VI but stage II dominated.

At Mandapam, 269 t of *C. macrolepidotus* was landed as against 368 t during the previous year but with a lesser catch per effort, all by trawlers, operating at a distance of 4-25 km and at depths ranging from 8-52 m. The size ranged from 8 to 40 cm, with modes at 14, 24 and 32 cm (Mean Lt. 24 cm.) The sex ratio was 11:14 and all gonadial maturity stages were avaliable with stages IV to VII dominating during March-September period. The mean fecundity was about 59,732.

Goatfishes

The goatfish production at Mangalore by trawlers was about 97 t which was 38% more than the previous year with a 15% increase in catch rate. *Upeneus vittatus* has contributed to about 64 t, followed by *U. sulphureus* (32 t). The former has ranged in length from 10-20 cm, with modes at 12 and 16 cm, and the latter varied from 9-20 cm, with the mode at 15 cm. The mean lengths for these species were 14.8 and 15.3 cm respectively. Stages III and IV dominated in *U. vittatus* and V and VI in *U. sulphureus.*

The goatfish production at Calicut was 148 t (c/e 6.3 kg) of *U. vittatus* and *U. sulphureus*, all by trawlers operating upto about 16 km from the coast at a depth of 25-60m. *U. vittatus* ranged in length from 15 to 18 cm, with the mode at 17 cm and mean at 16.6 cm. Maturity stages ranged from 1 to III, with stage II dominating.

At Cochin, 343 t of goatfish were landed by trawlers at a c/e of 7.6 kg. The peak catch of 238 t was in October (c/e 48.4 kg), but during the preceding 3 months of July-September, there was no landing at all. *U. bensasi* has formed the bulk of 73%, followed by *U. vittatus* 27%. *U. bensasi* has ranged from 8-16 cm with mode at 11 cm while *U.vittatus* varied from 8 - 17 cm with modes at 11 cm and 16 cm. Stages III-IV dominated in the former species and spent resting stage in the latter species during November-February.

At Tuticorin, the production was 675 t by trawlers operating at distances of 15-30km

and at depth ranges of 30-80 m. *Parupeneus indicus, U. vittatus* and *U. sulphureus* were the important species. The first species has ranged in length from 14-35 cm, with dominant modes at 19 and 23 cm. The vast majority were in stage I, although spent specimens were also avaliable. The food items consisted of juvenile crabs and molluscs.

At Mandapam, 232 t were landed, of which 204 t was by trawlers and the rest by shore-seines. *U. sundaicus* and *U. vittatus* have formed the only species, the former ranging in length from 8-18 cm and the latter from 9-19 cm. The estimated quantity of non-edible biota at Mandapam region was about 2,400 t.

In Madras, the goatfish production during the year has declined to 2,075 t from 3,437 t during the previous year. Trawlers operating at distance from 4 to 25 km at depths 10 to 50 m were the only gears. The catch rate was about 51 kg as against 88.3 kg during previous year. *U. sulphureus and U. bensasi* have mainly contributed to the fishery. The former ranged in length from 9-16 cm and the latter from 8-16 cm, with dominant mode at 12 cm. Maturity stages I to V were noticed.

Whitefish

At Mangalore, the annual production was 154 t as against 242 t during the previous year, thus registering a decrease of 36.5% and 45% in production and catch rate respectively. The size ranged from 6-24 cm, with mode at 15 cm and the mean at 15.4cm. Sex ratio was 3 males: 2 females, with availablity of all gonadial maturity stages, of which V and VI were dominant. The mean fecundity was 56,187.

In Calicut, the production was hardly 2 t, most of which by trawl nets, while in Cochin it was about 14 t, with a c/e of 0.3 kg. The maximum catch of 600 kg was in October while during July, August, December, February and March, there were no landings.

At Mandapam, the production was 18 t, mostly by trawl nets and to a lesser extent by trammel nets and shore-seines. The fish has ranged in length from 13-31 cm, with the modes at 19 and 24 cm and the mean at 20cm. 32% of the specimens were in maturity stages IV to VI during November-February. It is stated that indiscriminate fishing during the peak spawning season of November-February in the past could have resulted in the decline of the once flourishing fishery for the whitefish in the Gulf of Mannar.

Induced breeding and seed production of seabass (DF/CUL/3)

P. Nammalwar, R. Marichamy, A. Raju

During the year under report, 13 adult specimens were collected, of total length ranging from 46-95 cm and weight 1.5 to 9 kg, from the Palk Bay and Gulf of Mannar. The specimens so collected (mostly by cast nets) were in injured and moribund conditions. Inspite of providing good aeration of the water during transportation by oxygen cylinders, or of treating them with antibiotics like Amphicellin and Chloramphenicol soon after and/or during transportation as well as afterwards and inspite of treatments with one or the other of methylene blue, Dytetracyaline, acriflavine, nitroferozone and malachite green for curing injuries, diseases and handling stresses, ten specimens have died in the course of 1 to 18 days. Only three have survived and are kept in the tanks. Among them

two (46 and 72 cm, 1.5 and 5.5 kg respectively) are being reared in a concrete tank of 6.3 x 3.5 x 1.5m. Two male specimens (52 cm/2 kg and 58 cm/3 kg) were administered with the steroid hormone 3 - Estradiol - 17 B - diol for inducing maturation, during September and October; and are stocked in a fixed net cage of 2.5 x 2 x 1.5 m, put up at Krusadai Island. The specimens being reared are fed with small fishes such as *Chanos*, grey mullets, perches, sardines, etc.

Besides the capture of adults from the wild, the team of scientists has also been engaged in raising the adult stock from young ones cultured in the ponds at Mandapam. More than 90 specimens in the length ranges of 11.5 - 24.5 cm (20 - 215 gm) were collected from Pillaimadam lagoon and the adjacent areas during January 1993 with the mean length at 15.7 cm and weight at 161 gm.

Cultures, of *Chlorella salina*, *Brachionus plicatilis*, *Artemia salina* and *Moina macrura*, essential feed for the post larvae are being maintained at Mandapam.

CRUSTACEAN FISHERIES DIVISION

Investigations on the exploitation, management and conservation of penaeid prawn resources of west coast of India (CF/RE/1.11)

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Nearly 80% of the penaeid prawn resources of the country is exploited from the west coast. Under this project investigations on the prawn resources exploited by trawl and artisanal gears were carried out at Veraval, Bombay, Karwar, Mangalore, Cochin and Vizhinjam. During the year under report penaeid prawn catch registered increases over the previous year at New Ferry Wharf, Tadri and Sakthikulangara, whereas landings declined at Veraval, Karwar, Mangalore, Malpe, and Cochin. Salient features of the penaeid prawn fishery exploited by small trawlers are given below.

Trawl fishery

Veraval: The total penaeid prawn catch during the year amounted to 4,488 t (6.3 kg/hr) against 7,858 t (10.7 kg/hr) in the previous year, registering a decline of 43% in the total catch. Reduction in the longtrip operation to the northern Kutch region during October-March period resulted in the decline of prawn catch. Prominent constituent species were *Parapenaeopsis stylifera* (48.3%), *Solenocera crassicornis* (24.6%), *P. hardwickii* (10.3%), *Metapenaeopsis stridulans* (4.8%), *Metapenaeus monoceros* (3.1%) and *M. kutchensis* (3.1%). *P. merguiensis* and *P. semisulcatus* were caught in small quantities.

Dominant size classes supporting the fishery were 76-110 mm in *P. stylifera*, 66-110 mm in *P. hardwickii*, 106-120 mm in *M. kutchensis*, 126-160 mm in *M. monoceros*, 131-170 mm in *P. merguiensis* and 151-200 mm in *P. semisulcatus*.

Bombay: At Sassoon Dock 16,553 t of prawns were landed by trawlers at a c/e of 860 kg. *P. stylifera* contributed to more than 50% of the catch followed by *M. affinis* (19.3%) and *M.monoceros* (15%)

At New Ferry Wharf the total prawn catch was 18,629 t (c/e 615 kg) against 16,768 t (c/e) 560 kg, in the previous year, thus showing an increase of 11.1% in catch and 8.4% in catch rate. The catch was dominated by *P. stylifera* (30.8%), *M.affinis* (14.9%), *S.crassicornis* (13.9%), *M.monoceros* (13.4%), *M.kutchensis* (7.6%) and *M.stridulans* (5.5%).

73-103 mm size classes in *P.stylifera*, 68-103mm in *S.crassicornis*, 113-148mm in *M.affinis* and 113-178mm in *M.monoceros* formed the mainstay of the fishery.

Karwar: Considerable decline in the prawn landings was recorded at Karwar. The total catch amounted to 155 t (c/e 20.5 kg) against 733 t (c/e 61kg) in 1991-92. Drastic decline in the landings of *P.stylifera* from 518 t in 1991-92 to 62 t in 1992-93 resulted in the poor prawn production. *P.stylifera* (40%) and *M.dobsoni* (53.9%) were the principal species supporting the fishery. *M.affinis*, *M.monoceros* and *P. merguiensis* accounted for the rest of the catch.

At Tadri, small trawlers landed 1,500 t of prawns (c/e) 68 kg during the year against 894 t (c/e 47.3 kg) in the previous year. The major species supporting the fishery were *P.stylifera* (64.3%),*M.monoceros* (25.8%) and *M.dobsoni* (5.5%). Both *P.stylifera* and *M.monoceros* showed increases over the previous year. Prominent size groups were 61-95 mm in *P.stylifera*, 61-85 mm in *M.dobsoni* and 106-135mm in *M.monoceros*.

Mangalore: Catch and catch rate declined over those of the previous year. The catch in 1992-93 amounted to 1,519 t (c/e 40.1 kg) against 2,363 t (c/e 58.9kg) in 1991-92. Principal constituents were *M.monoceros* (39.8%) *P.stylifera* (35.3%), *M.dobsoni* (14.8%) and *P.indicus* (2.9%) *P.monodon* and *P.canaliculatus* supported minor fisheries.

At Malpe, the prawn catch declined from 868 t (c/e 29.7 kg) in 1991-92 to 820 t (c/e 24.4 kg) in 1992-93. *P. stylifera* (42.7%), *M. monoceros* (31.4%) and *M. dobsoni* (21.8%) were the dominant constituents. 63-83 mm sized *M. dobsoni*, 73-98 mm *P. stylifera* and 103-143 mm *M. monoceros* formed the mainstay of the fishery.

On the Kerala coast a ban on monsoon trawling was imposed for 22 days from 21.6.1992 to 12.7.1992. An extremely good *Karikkadi (P. stylifera)* fishery was recorded at Sakthikulangara in the monsoon period (June-September) due to active trawl fishing during the non-ban period. *Karikkadi* catches in the monsoon season declined at Cochin Fisheries Harbour owing to the diversification of effort for cephalopod fishing.

Cochin Fisheries Harbour: 6,351 t (c/e 71.3 kg) of prawns were landed by trawlers in 1992-93 against 12,245 t (c/e 113.3 kg) in the previous year. Catch and catch rate declined to the tune of 48% and 37% respectively. This was largely due to the poor showing of *Karikkadi* in the monsoon season. The catch of *Karikkadi* in the monsoon months declined from 7,150 t in 1991 to 1,572 t in 1992. Trawlers were mainly engaged for fishing cephalopods in deeper waters during this period as this resource fetched better unit value.

Karikkadi (43.7%) and *Poovalan (M. dobsoni)* (41.8%) formed the backbone of the fishery at Cochin. Other constituents in their order of abundance were *M. monoceros* (6.2%), *P. indicus* (4.9%), *M. affinis* (1.4%), *Trachypenaeus* spp. (1.3%), *P. canaliculatus* (0.4%), *P. semisulcatus* (0.3%) and *P.monodon* (0.1%). *M. monoceros*, *Trachypenaeus* spp., *P. semisulcatus* and *P.canaliculatus* were largely caught in night trawling.

61-90 mm size classes in *Karikkadi* and 71-95 mm in *Poovalan* dominated the fishery. In both species premonsoon and postmonsoon (December-March) periods formed the peak spawning season.

Sakthikulangara: The total prawn catch amounted to 15,318 t (c/e 85 kg) against 13,939 t (c/e 88 kg) in the previous year. This was the maximum prawn catch recorded at this centre since 1980. *Karikkadi* landings were extremely good in the monsoon season (9,256 t). *Karikkadi* (72%) and *Trachypenaeus* spp. (12.5%) were the two dominant constituents of the fishery followed by *Poovalan* (5.2%), *P. indicus* (3.9%), *M. affinis* (2.0%), *M. monoceros* (1.6%), *P.canaliculatus* (2.1%) and *P.semisulcatus* (0.2%). Nearly 45% of the trawlers were engaged in night trawling between October to March result-

ing in good landings of *Trachypenaeus* spp. and *P. canaliculatus*.

Purse seiners landed 54 t of prawns in 1992-93 against 6.2 t in 1991-92 at Mangalore. *M. dobsoni* formed 99.2% of the fishery, the rest being accounted by *P. stylifera*.

Prawn fishery in the artisanal sector

Chakara (Mudbank) was active in the districts of Alleppey and Trichur of Kerala in June and July resulting in good prawn landings. *Poovalan* formed 80 – 90% of the prawn fishery and the rest by *Naran (P. indicus)*. Adult prawns of the size 81-95 mm in *Poovalan* and 136-155 mm in *Naran* supported the Chakara fishery. *Ring seine* was the main gear employed for fishing in *Chakara* waters.

At Fort Cochin, *ring seine* operations in monsoon landed 77 t of prawn (c/e 27kg) of which *Naran* formed 63% and *M. dobsoni* (37%).

Gillnets and cast nets landed 8 t (c/e 2.3 kg) and 22 t (c/e 40kg) of prawns respectively at Puthuvyppu in the monsoon season. *Naran* formed the entire catch of gillnet operations, while *M. affinis* (68%), *P. indicus* (14%) and *M. dobsoni* (11%) contributed to the cast net catch.

Discovala (trammel net) landed 26 t (c/e 2 kg) at Vizhinjam, 13 t (c/e 1.7 kg) at Valiathura and 20 t (c/e 2.5 kg) at Colachel, the catch being exclusively composed of *P. indicus*. The entire catch was landed in monsoon months.

Stake nets landed 363 t (c/e 4.4 kg) of juvenile prawns at Thevara and 255 t (c/e 3.5 kg) at Elamkunnapuzha. *Poovalan* formed 75 – 81% of the catch followed by *P. indicus* (11 – 13%) and *M. monoceros* (8 – 13%) at these centres. Poovalan of the size 46-55mm dominated the fishery.

Studies on exploitation, management and conservation of lobster and crab resources of Indian coast (CF/RE/1.14)

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Crabs and lobsters contributed to 7.1% and 0.5% of the crustacean landings of the country respectively. Crabs are mainly exploited in Tamilnadu, Gujarat, Kerala and Karnataka and lobsters in Tamilnadu, Gujarat, Maharashtra and Kerala. These resources were studied at Veraval, Bombay, Karwar, Mangalore, Cochin, Vizhinjam, Tuticorin, Mandapam and Madras.

Crab resources

Veraval: The total catch of crabs by trawlers was 1,466 t (c/e 20.8 kg), registering a decline of about 62% over the previous year. This was mainly due to the decrease in the long trip operations to northern Kutch. *Charybdis lucifera* formed the bulk of the catch.

Bombay: At New Ferry Wharf, trawlers landed 286 t at a c/e of 9.5 kg showing an increase of about 46% in catch and 44% in catch rate over the previous year. *Charybdis feriatus* formed 94% of the catch. *Portunus sanguinolentus* and *P. pelagicus* contributed to the rest of the catch.

Karwar: Trawl nets landed 8.3 t of crabs at a c/e of 1kg. *P. pelagicus* formed 64% and *P. sanguinolentus* 36% of the catch. Dominant sizes were 91 – 136 mm in the former and 84-124 mm in the latter.

Mangalore: Trawlers registered a catch of 543 t (0.9kg/hr) at Mangalore and 244 t (0.7kg/hr) at Malpe. At both centres catch showed an increase over the previous year. *P. sanguinolentus* dominated at Mangalore (83%) and Malpe (63%).

Cochin: In the trawler landings, crabs amounted to 412 t (c/e 4.7kg) against 542t (c/e 5.0kg) in the previous year. Maximum landings took place between December and March. *C. feriatus* dominated followed by *P. sanguinolentus*.

Tuticorin: Gillnets landed 122 t of crabs (c/e 12.4kg) at Tharuvaikulam, the catch being dominated by *P. pelagicus* (99.5%). 108-143mm size crabs dominated the fishery.

Mandapam Camp: Crabs exploited by trawlers amounted to 227 t (0.8kg/hr) at Rameswaram and 586 t (0.4kg/hr) at Mandapam. Entire catch was composed of *P. pelagicus*. *Nanduvalai* (Gillnet) landed 166 t of crabs mainly *P. pelagicus* (80%) at Thoppukadu and Devipattanam. *Scylla serrata* formed the rest of the catch. Mudcrab fetched Rs. 160/-per kg.

Madras: Trawlers registered a catch of 890 t (4.4 kg/hr) with peak landings from August to October. *P. sanguinolentus* (43%), *P. vigil* (15%), *C. lucifera* (14%), *P. pelagicus* (12%) and *C. smithii* (11%) were the component species.

Lobster resources

Sand lobster, *Thenus orientalis* landings have declined to an alarming level at Bombay waters. This species which supported about 46% of the lobster catches of trawlers until 1985 has plummeted to 4% in 1992-93 mainly due to indiscriminate fishing. Being slow growing with restricted spawning period, this species may disappear from the fishery if appropriate conservation measures are not taken immediately.

Veraval: Lobster landings in trawlers amounted to 145.4 t (c/e 2.1kg), the catch declined by 16% over the previous year. *P. polyphagus* formed (51%) and *T. orientalis* (49%). In *P. polyphagus* 61-70mm size in carapace length and in *T. orientalis* 146-170mm in total length dominated the fishery. Berried females of both species appeared in post monsoon months.

Bombay: Trawlers landed 67 t (c/e 2.2kg) against 83 t (c/e 2.8kg) in 1991-92. *P. polyphagus* formed 96% and *T. orientalis* 4% of the catch. In *P. polyphagus* 175 – 280mm size dominated the fishery. 3 year old lobsters formed 40 – 47% of the catch. During 1976 to 1985 period, 4th and 5th year classes dominated the fishery. This shows that this species also face a similar situation to that of *T. orientalis*.

Vizhinjam: Trammel nets landed 2t (c/e 1 kg) at Vizhinjam and 4.5 t (c/e 1.4kg) at Paravoor. Maximum landings occurred in September followed by February and April. *P. homarus* formed the entire catch with 161-195mm sizes dominating in the fishery.

Tuticorin: Bottom set gillnets landed 4 t of lobsters with a c/e of 0.4kg. *P. ornatus* formed 83% and *P. homarus* 17% of the catch. In *P. ornatus* 155 – 225mm sizes dominated.

Mandapam: Trawlers landed 3.7 t of *P. ornatus* with maximum landings between October and March. 141-150mm sized lobsters dominated the catches.

Madras: At Kovalam, gillnets fished 4.5 t of lobsters at a c/e of 1kg. *P. homarus* supported 68% of the fishery followed by *P. ornatus* (18%) and *P. versicolor* (13%).

Investigations on the exploitation, management and conservation of penaeid prawn resources of the east coast of India (CF/RE/1.12)

G. Sudhakara Rao, V. Thankaraj Subramaniam, G. Maheswarudu, M. Rajamani.

East coast accounts for nearly 20% of the penaeid prawn landings of the country. Penaeid prawns landed by trawl and artisanal gears were monitored at Paradeep, Puri, Visakhapatnam, Kakinada, Madras, Mandapam and Tuticorin. A review of the prawn fishery by small trawlers at Paradeep and Visakhapatnam for the last 4 years shows that the fishery in general is steady with no threat of overfishing at Paradeep, whereas at the latter centre stocks of *Penaeus indicus* and *Metapenaeus monoceros* are exhibiting symptoms of overfishing. An analysis of the prawn fishery by large trawlers in the north eastern coast indicates that further introduction of trawlers can lead to biological and economic overfishing. Important features of the prawn fishery by trawl and artisanal gears at various centres of investigations are summarised below.

Paradeep: The prawn catch by small trawlers in 1992-93 amounted to 2,361 t (13.7kg/hr) against 2,192 t (10.4kg/hr) in 1991-92. A unique feature of the fishery was heavy landings in April-May which is considered to be a lean season. Important constituents were *M. dobsoni* (36.0%), *P. hardwickii* (9.4%), *P. stylifera* (7.6%), *M. affinis* (4.0%) and *M. monoceros* (3.6%). *P. merguiensis* and *P. monodon* together formed 1.3%. Other small sized penaeids formed nearly 36% of the catch. A review of the fishery by small trawlers at this centre shows that the catch declined from 2,477 t in 1989-90 to 1,906 t in 1990-91 but increased to 2,361 t in 1992-93. Catch/hour of trawling declined from 11.3kg in 1989-90 to 8.4kg in 1990-91 and increased in the following year to reach the present level of 13.7kg. Fishery is generally stable with no signs of overfishing.

Visakhapatnam: The year 1992-93 witnessed the poorest fishery in the last 15 years period for small trawlers. The total catch was 388 t (1.8kg/hr) against 500 t (1.6kg/hr) in the previous year. Maximum landings occurred from February-July. Important constituents in the order of abundance were *P. indicus* (28.9%), *M. monoceros* (18.8%), *Metapenaeopsis* spp. (13.4%), *Solenocera* spp. (10.1%), *P. longipes* (8.8%), and *M. dobsoni* (6.2%). *P. monodon* and *P. semisulcatus* supported minor fisheries. Size classes dominating the fishery were 143-198 mm in *P. indicus* and 108-168 mm in *M. monoceros*. Ripe females of *P. indicus* were available from July to January.

A review of the prawn fishery of small trawlers shows that the fishery has declined from 564 t in 1989-90 to 388 t in 1992-93. Introduction of *Sona* boats has affected the economy of small trawlers. *P. indicus* and *M. monoceros* together contributed to 321 t in 1989-90 period and catches of these two species declined to 185 t in 1992-93 showing symptoms of overfishing.

An analysis of the prawn fishery of large trawlers in the north eastern waters shows that the fishery which started with 37 trawlers in 1978 has grown to the present level of 170 large trawlers and 80 mini trawlers. Prawn landings increased from 1,307 t in 1978-79 to 1,783 t in 1987-88. Landings increased in the subsequent two years and reached 3,560 t in 1989-90. Since

then the catch declined to reach the present level of 3,087 t in 1991-92. Catch/hr of trawling varied between 14.1 kg to 20.1 kg from 1980-81 to 1984-85. In the following years catch/hr of trawling showed steady decline to reach the present level of 10.2 kg. At this level, most of the vessels are finding difficult to continue the fishing. It appears that further increase in the number of trawlers in the area will lead to biological and economic overfishing.

Kakinada: Prawn catch by small trawlers declined from 4,067 t (7.4 kg/hr) in 1991-92 to 3,966 t (5.7 kg/hr) in 1992-93. Maximum landings occurred from December to May. Principal contributing species were *M. monoceros* (23.1%), *M.dobsoni* (21.2%), *P. indicus* (7.4%) and *P. semisulcatus* (5.1%), *M. affinis, P. merguiensis* and *P. monodon* together formed 7.6%. Commercially unimportant penaeids formed about 35% of the catch. Most of the trawlers were fishing in shallow waters resulting in the capture of small sized *M. monoceros* in which 73-113 mm sizes dominated. Dominant sizes in other species were 58-98 mm in *M. dobsoni*, 103-163 mm in *P. indicus* and 135-245 mm in *P. monodon.*

Madras: The total prawn catch amounted to 1,938 t with a catch rate of 9.5 kg/hr of trawling. January to April formed the peak fishing season. Dominant species were *M. dobsoni* (22.0%), *P. indicus* (16.4%), *P.maxillipedo* (10.9%), *M. stridulans* (9.9%), *M. monoceros* (7.4%) and *P. semisulcatus* (4.8%). In *M. dobsoni* 61-105 mm size classes dominated the fishery. Peak spawning months were, June, October and March.

Mandapam: Trawlers operating at Mandapam, Pamban and Rameswaram together landed 4,308 t (3.1 kg/hr) of prawns in 1992-93 against 3,513 t (2.5 kg/hr) in the previous year. Catch and catch rate showed increase of over 23% against the previous year. Important constituent species were *M. stridulans* (49.8%) and *P. semisulcatus* (32.8%) at Mandapam, *P. semisulcatus* (63.0%) and *P. maxillipedo* (20.0%) at Pamban and *M. stridulans* (48.0%) and *P. semisulcatus* (24.6%) at Rameswaram. Dominant size classes of *P. semisulcatus* were 126-135 mm at Mandapam, 126-145 mm at Pamban and 116-135mm at Rameswaram. July-September and January-March were peak spawning months for this prawn.

Tuticorin: At Tuticorin Fisheries Harbour, the trawlers landed 304 t of prawns at a c/e of 10.3 kg. *P. semisulcatus* formed more than 80% of the catch. Good landings were obtained between May to October. In *P. semisulcatus* 118-183 mm sizes dominated. Peak spawning months were June and August to October.

Artisanal prawn fishery

Puri: Gillnet operations landed 57t of prawns at a catch rate of 0.5 kg/hr of operation. 93% of the catch came in September and October. *P. indicus* (76.7%), *M. affinis* (13.4%) and *P. merguiensis* (9.2%) were dominant constituents.

Mandapam: *Thallu valai* landed about 12 t of *P. semisulcatus* at Chinnapalam and Devipattanam with a catch rate ranging between 0.2 – 0.4 kg/hr. Prawn landings declined by about 31% over the previous year. The fishery was dominated by 111 – 120 mm sizes at Chinnapalam and 81-95 mm at Devipattanam.

Madras: At Ennore estuary, stake nets landed 852 t of prawns at a c/e of 132 kg.

Maximum landings took place from December to March and August to October. Species supporting the juvenile fishery were *P. indicus* (28.7%), *M.dobsoni* (26.3%), *M. monoceros* (24.0%) and *P. semisulcatus* (12.3%).

Investigations on the exploitation, management and conservation of non-penaeid prawn resources of the north west coast of India (CF/RE/1.13)

V.D. Deshmukh, K.K. Philippose, M. Aravindakshan

About 96% of the non-penaeid resources of the country are contributed by the States of Gujarat (59.4%) and Maharashtra (36.6%). These resources are exploited by trawl and *dol* nets. Detailed investigations were carried out on these resources from Veraval and Bombay under this project. At Veraval non-penaeids contributed to about 84% of the crustacean catch in the trawlers. Centre wise details are summarised below.

Veraval: Non-penaeid prawn landings by *dol* nets increased by 61% at Nawabander and 10.5% at Rajpara over the previous year. At Veraval trawler operations showed an increase of 8% in the non- penaeid prawn landings.

At Nawabander, the total non-penaeid landings amounted 3,053 t (c/e 118.5 kg) against 1,892 t (c/e 77.1 kg) in 1991-92. Non-penaeids formed 87% of the crustacean catch. *Acetes* spp. formed 68% followed by *Nematopalaemon tenuipes* (18%) and *Exhippolysmata ensirostris* (15%). Postmonsoon was the most productive period.

At Rajpara 2,591 t (c/e 88 kg) of non penaeid prawns were landed against 2,345 t (c/e 83 kg) in the previous year. This resource formed 72% of the crustacean catch. *Acetes* spp. (54%), *N. tenuipes* (25%) and *E. ensirostris* (21%) were the constituent species.

Trawlers landed 37,096 t (c/e 526 kg) of non-penaeid prawns in 1992-93 against 34,288 t (c/e 514 kg) in 1991-92. This resource formed 84% of the crustacean catch landed by trawlers. Almost the entire non-panaeid catch was formed by *Acetes* spp.

76-80 mm size *E. ensirostris* and 41-52 mm size *N. tenuipes* dominated the fishery. *E. ensirostris* breeds throughout the year with peaks in postmonsoon and postwinter months.

Bombay: Non-penaeid catches declined in trawl and *dot* net operations. *Dol* nets landed 121 t (14.1 kg/hr) at New Ferry Wharf and 4,629 t (30.6 kg/hr) at Versova. Catch declined by 45% at Versova and 23% at New Ferry Wharf. *Acetes* spp. formed the dominant catch at both centres, composition being 88% at Versova and 93% at New Ferry Wharf. This was followed by *N. tenuipes* contributing 10% of the catch at Versova and 5% at New Ferry Wharf. *E. ensirostris* formed the rest of the catch.

In the trawler landings the non-penaeids declined at New Ferry Wharf by 17% and at Versova by 42% over the previous year. The catch amounted to 585 t (0.5 kg/hr) at New Ferry Wharf and 368 t (1.5 kg/hr) at Versova. *N. tenuipes* formed the entire non penaeid catch in the trawlers.

40-60 mm sizes in *N. tenuipes* dominated *dol* net and trawl fishery, the juveniles forming 7% of the catches in both gears. Berried females were abundant in March and August.

In *E. ensirostris*, 53-83 mm size classes formed the bulk of the fishery. Monsoon was the peak breeding season of this prawn.

Sea ranching of marine prawns (CF/CUL/1.7)

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The prawn hatchery at Mandapam Camp produced a total of 21.6 lakh postlarvae of *Penaeus semisulcatus*. Of this, 11.5 lakh postlarvae came from the breeders maintained at the broodstock facility of this station. The postlarvae were further reared in nurseries and 13.7 lakh postlarvae XIV-XXXII were released in the Palk Bay as a part of sea ranching project.

Cage culture of *P. semisulcatus* in the Valinokkam Bay and Mandapam was initiated during the year and the results were encouraging. Within 120 days, the juveniles stocked in the cages gained an average wt. of 20 g.

Experiments carried out on the induced maturation of *P. semisulcatus* revealed that, by effecting environmental manipulation (without eye ablation) like pH regulation and controlling light intensity, this species could be induced to mature and spawn within a minimum period. A single prawn has spawned 8 times during this year always releasing viable eggs. There was no decrease in the fecundity. It was also revealed that these prawns spawned 2-3 times in an intermoult period.

High density transportation experiments of nauplii of *Penaeus indicus* yielded good results. It was confirmed that they can be transported at a density of 1,00,000 nauplii/l with 100% survival in a journey period of 24 hrs. Nauplii were transported from Tuticorin to Cannanore and were further reared in the hatchery to postlarvae XIV. The development of larvae was normal and no side effects due to packing and transportation stress were observed in their subsequent development. The cost of one lakh nauplii of *P. indicus* works out to Rs. 250-300 and the same could be sold at a rate of Rs. 550-600.

Crustacean Fisheries Division is executing a consultancy service to Bharati Vidyapeeth, Pune to establish a penaeid prawn hatchery in the Konkan coast of Maharashtra for production as well as training. The cost of the consultancy is two lakhs. The Scientists of this division, after visiting the coast, has selected a site north of Srivardhan.

BREAKTHROUGH

A breakthrough in prawn seed transportation. Nauplii of the white prawn *Penaeus indicus* packed in collapsible plastic bags with oxygen (1 lakh nauplii/litre) were transported with 100% survival from Tuticorin to Cannanore.

Breakthrough in seed production of seacucumber. Nearly 20,000 juveniles of *Holothuria scabra*, produced by induced spawning in the hatchery at Tuticorin have been sea-ranched.

COLLECTION OF TUNA LIVE - BAITS

Sprats are being collected from the lagoons of northern islands in Lakshadweep for using them as live-baits in pole and line fishing for tuna

WHITE BAND DISEASE

The coral *Acropora formosa* from Kavaratti in Lakshadweep showing infection of the 'White Band Disease' The disease is widespread in the Indo-Pacific leading to mortality of corals.

RANCHING OF CLAMS

Ranching of the clam *Paphia malabarica* in the Ashtamudi Lake (Quilon) to augment production. Ranching was also done at Munambam in Vembanad Lake (Cochin)

MOLLUSCAN FISHERIES DIVISION

Investigations on the resource characteristics of cephalopods (MF/RE/1)

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The cephalopod production in the country has further improved this year. The annual landings by trawl in Bombay were over 27,000 t as against 19,500 t last year. Bulk of the catch (75.5%) was landed at New Ferry Wharf and the rest at Sassoon Docks. Of the total cephalopods, squids amounted to 15,000 t and cuttlefish 12,000 t. The monthly c/e ranged upto 951 kg for squids and 840 kg for cuttlefish. The fishery has improved at centres like Mangalore-Malpe (2,708 t), Cochin (6,000 t), and Madras (1,893 t), while it was nominal or poor at Karwar, Calicut, Vizhinjam, Tuticorin, Mandapam, Rameswaram, Kakinada and Visakhapatnam. The fishery was mainly supported by three species, the squid *Loligo duvaucelii*, and the cuttlefishes *Sepia pharaonis and S. aculeata*. Octopus landings were negligible. At Bombay, where cephalopod exploitation is very high, the mortality parameters and stock position of *L. duvaucelii* were estimated based on 1992-93 data, and it was observed that the total stock is to the tune of 71,365t, standing stock 33,466 t; MSY 28,100 t and the present yield 15,000 t.

Monitoring of bivalve and gastropod resources (MF/RE/2)

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Green mussel

The estimated production of green mussel *(Perna viridis)* on the Malabar coast was about 5,100 t, obtained at a c/e of 70 kg/manday. The maximum monthly catch of 88 t was in April. The size ranged from 40-135 mm with modes at 95 mm and 110 mm. Good spat settlement was observed (6,600 seed/m^2) in October. The mussel was priced high throughout the year and fetched upto Rs. 500/- for 100 kg (shell-on) in February-March. In Cochin, mussel fishery has improved and the price of mussel meat was around Rs. 25/- per kg.

Brown mussel

The production of brown mussel *(Perna indica)* on the Vizhinjam- Colachel coast was 674 t, about 140 t less than previous year. Compared to the green mussel, the c/e of brown mussel was much less, 18 kg/manday. Peak fishery was during August-December. The price varied from Rs. 6–11 for 100 mussels.

Clams

The fishery for clams belonging to the genera *Meretrix*, *Paphia* and *Anadara* in Bombay, and for *Meretrix meretrix* in Kali estuary in Karwar was on a small scale. The production in Mulki estuary in Mangalore was 227 t, of which 92% were *M. casta* and the rest *P. malabarica*. In Calicut about

240 t of the marine clam *Sunetta scripta* were exploited from the barmouth of Korapuzha. One important observation was that the entire clam bed of this species at the barmouth of Chettuva estuary was destroyed by heavy settlement of the weaving mussel *Modiolus* during the pre-monsoon period. One eradicative measure suggested is to collect and utilize *Modiolus* as duckfeed as being done in some parts of the Vembanad Lake. The total catch of *S. scripta* from Fort Cochin and Vypeen Island was 2,710 t. The price varied from Rs. 330/- to Rs. 380/- per tonne. The production of the black clam *Villorita cyprinoides* in Cochin amounted to 7,315 t at Muhamma, 2,653 t at Vechoor, 319 t at Nettur and 244 t at Kumbalangi. A highest price of Rs. 455/- was realised at Vechoor. There was limited exploitation of live clam in Pulicat Lake. However, quarrying of subfossil shell deposits continued almost throughout the year. The monthly quantity exploited varied from 45 t to 495 t, the value realised ranging from Rs. 86,000-8,80,000. The clam production from Kakinada Bay was 1,941 t. *Anadara granosa* continued to be the most dominant clam amounting to 1,032 t followed by *M. casta* (770 t), *M. meretrix* (115 t) and *P. malabarica* (14 t).

Oysters

The rock oyster *Saccostrea cucullata* forms extensive beds along Bombay and New Bombay coasts. They are fished on a very small scale for edible purpose. The main fishing centres are Haji Ali, Worli, Bandra and Madh Island. The average density of occurrence was about 785 oysters/m^2.

A survey of nine estuaries in Calicut region indicated good settlement of the common edible oyster *Crassostrea madrasensis* in some of the estuaries with a density of 15-250/m^2. Fishery is very much restricted. In Cochin, this oyster is occasionally exploited at Kannamali and Munambam. Oyster beds were observed in Kandaleru estuary near Madras and also in the fishing harbour; at both these places together there is an estimated stock of 89 t.

Chank

No regular licenced chank fishing was conducted this year because of the Tamil Nadu Government Policy. However, over 1,26,000 chanks were landed in Ramnad District as by-catch in trawl fishing, mostly during April and May. The *jadhi* variety of chanks *(Xancus pyrum* var. *acuta)* formed about 18% and the *patti* variety *(X. pyrum* var. *obtusa)* the rest. Sixteen chanks tagged and released earlier were recaptured in 234 to 1,020 days after release, and they have indicated a growth rate of 0.23 mm to 0.72 mm per month. While some chanks were recaptured from the place of release within a period of 234 to 691 days, two have travelled 7 km. In Tuticorin also there was no regular chank fishery. A total of 228 chanks, collected by SCUBA diving were tagged and released. Recoveries of chanks tagged earlier indicated a growth increase of 1-7.6 mm in length (wt. 5-49 g) in a period of 12-22 months.

Seed production and sea-ranching of molluscs (MF/CUL/4)

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During this year good progress was made

in the seed production in pearl oyster, edible oyster and clam hatcheries at Tuticorin. Progress was slow in the mussel seed production programme at Calicut for want of hatchery facilities.

Tuticorin

Pearl oyster hatchery: In the first quarter 69,540 spat of *Pinctada fucata* were produced from the spawning that occurred on 20 February '92 and these were shifted to the farm. In June, by induced spawning 19.65 lakhs larvae were obtained and about 1.42 lakhs of spat produced were transferred to the farm in September 1992.

During the second quarter, though there was spawning, larval rearing could not be carried out as the rearing tanks were full with the spat reared from June spawning.

In the third quarter, out of five spawning experiments, two resulted in mild spawning and 8.75 lakhs of larvae were obtained. Settlement was poor resulting in only 4200 spat and this was attributed to dilution of the Bay water reaching 10.7 ppt salinity subsequent to the cyclonic storm on 13th November '92. The drop in salinity also adversely affected the gonadial maturity of the pearl oysters and the microalgal food production.

In the last quarter mild spawning occurred on 3 March '93 resulting in 11.5 lakhs larvae and a profuse spawning on 17 March '93 yielding about 6 million larvae. In view of the expanded hatchery operations, difficulties were experienced in supplying adequate quantities of microalgal food.

The Research Vessel *Cadalmin* was laid up for repairs and as a result the sea ranching of pearl oyster spat could not be taken up.

Edible oyster hatchery: Out of 26 spawning in *Crassostrea madrasensis*, 13 were successful resulting in spat settlement. The oysters spawned in all the months except during December 92 and January 93. The cyclone in November affected the hatchery work. On an average 450 empty oyster shells as cultch were spread in each one tonne rearing tank before the release of eyed larvae. The quarter-wise details of spat production are given below.

	Details	Apr.-Jun.	Jul.-Sep.	Oct.-Dec.	Jan.-Mar.
1.	No.of eyed larvae	43,50,000	6,75,000	21,20,000	2,18,400
2.	% settlement of eyed larvae	9.65	25.8	30.05	51.0
3.	% settlement of one-day old larvae	0.75	1.25	4.68	2.06
4.	Total spat collectors (shells) used	17,000	4,000	12,700	2,000
5.	No. of shells received spat	4,474	1,550	6,820	900
6.	% of shells with spat settlement	26.31	38.7	53.7	45.0
7.	No. of spat/shell	93	112.4	78.5	125
8.	Total spat	4,19,965	1,74,320	6,37,144	–
9.	Spat/tank	12,237	21,790	25,485	28,125
10.	Spat/m^2	6,118	10,895	12,742	14,062

The spat production from the eyed larval stage was 18.25% and 13.43 lakhs of spat have settled on oyster shells. Good settlement occurred in the third quarter. The average number of spat/shell was 98.

A total of 2,290 shell strings were raised from the hatchery operations during this year.

Clam hatchery: There was profuse spawning of *P. malabarica* on 15 September '92. The larval strength was estimated at 50 million, but due to space and food constraint only 4.7 million larvae were reared. Settlement began on the 10th day. The details of spat rearing are given below.

Period	No.of spat	Size
September end	10,20,000	252 μ
October end	7,79,225	774 μ
November end	2,29,959	3.235 mm
December end	1,95,230	1.678, 2.779 and 8 mm

For convenience they were divided into 3 groups and the mean size of each group was given.

Owing to the cyclone in November '92 and subsequent flooding the salinity in the Tuticorin Bay dropped to 11 ppt on 8 December '92. This resulted in failure of algal cultures and heavy mortality of the clam seed.

On 18 February '93 a total of 64,000 seed of *P. malabarica* measuring 12.4 mm were ranched in 25 sq.m. area in the Ashtamudi. On 19 March '93 they have grown to 20.4 mm length. Preliminary studies indicate considerable mortality due to crab predation. Another consignment of 30,000 seed (av. Lt. 4.9 mm) were kept in cages in the same area for planting in the field at a later date.

At Munambam, 8,500 seed of *P. malabarica* (Lt. 12.4 mm) were transplanted on 19 February '93 in 10 sq.m. area to study whether this species could be established there. On 26 March '93 they have grown to 24.1 mm length.

Microalgal food production: Stock cultures of several microalgae were maintained and mass culture of *Isochrysis galbana* was continued. Daily 120 to 300 litres of *I. galbana* were harvested and supplied to the clam, pearl oyster, edible oyster and sea cucumber hatcheries. The cell concentration of the algae in the cultures ranged from 0.6 to 2.3 million/ml. During December '92 fall in salinity adversely affected the microalgal cultures.

Calicut

Green mussel hatchery: The brood stock of the green mussel *Perna viridis* were collected during April-July and September and maintained in nylon bags/cages suspended from a floating structure in the sea, 2 km away from the shore. Nine induced spawning experiments were conducted by thermal stimulation. In four experiments females spawned and the ova were not fully ripe. During May-November the coastal waters off Calicut were turbid. Unusual blooms of *Noctiluca* were observed for prolonged periods and would have adversely affected the reproductive cycle of the mussels. It is stated that the mussels kept in the laboratory along with *Ulva* sp., *Chaetomorpha* sp. and *Enteromorph* sp. derive nutrition from the reproductive bodies released by these algae.

Absence of infrastructure facilities was expressed as a constraint for the slow progress in the work.

Selection of suitable sites for oyster culture (MF/CUL/8)

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At Madras, the edible oyster *C. madrasensis* cultured off-bottom in cages at Pulicat Lake during 91-92 were harvested in June 1992 after one year which yielded 344 kg (meat 21 kg). The average length attained was 89.6 mm with a growth rate of 7.5 mm/month. Survival rate was 55.6%. Compared to the earlier experiments from the same area this study showed faster growth and higher meat content. It is concluded that Pulicat Lake is suitable for edible oyster culture.

The studies conducted at Kakinada, Karwar and Madras (Pulicat Lake) by transporting the edible oyster seed from Tuticorin hatchery gave the following results.

	Karwar	Kakinada	Madras
Initial length mm	25.8	27	18.5
Final length mm	52.7	72.0	70.1
Duration	6 months	8.5 months	12 months

These studies indicate that all the three areas are suitable for edible oyster culture.

Semi-commercial production of edible oyster (MF/CUL/9)

M.E. RAJAPANDIAN, K. RAMADOSS, RANI PALANISAMY

This project is operated at Tuticorin in collaboration with NABARD. During this period a total of 3,036 shell strings were transferred from the hatchery to the nursery and oyster farm. In all, 7,600 strings with oyster seed were stocked in the farm. The oyster farm comprises a total of 95 racks in 0.76 ha. The details are given below.

Period Quarter	No. of strings transferred from hatchery	No. of strings in the nursery	No. of strings in the farm	No. of racks	Area of farm
I	746	2170	2100	21	0.16 ha
II	1004	850	4960	67	0.55 ha
III	1136	746	6600	75	0.6 ha
IV	150	882	7600	95	0.76 ha

The average growth of *C. madrasensis* in the farm was 16.6 g/month and the survival during the 12-months period was 56.2%.

An Edible oyster Harvest Mela was conducted at Tuticorin on 27 March '93. Shri. D. Jayakumar, Hon'ble Minister Fisheries, T.N. inaugurated the festival. All aspects of oyster culture was demonstrated to a larger gathering of VIPs and public. A workshop was conducted on the same day afternoon on edible oyster resources and culture prospects.

Upgradation, location testing and transfer of technology of pearl culture (MF/CUL/10)

A.C.C. Victor, S. Dharmaraj

In pearl culture good progress was made in nucleus implantation. During 1992-93 out of 15,825 pearl oysters implanted with nucleus, 13,131 received single, 2,525 double and 169 triple implantation. The cyclonic storm on 13 November '92 caused considerable damage to the rafts moored in Tuticorin harbour. Two rafts were broken to pieces and 37 cages containing 52,300 oysters were lost. Of these, 2,300 were implanted with nucleus and the rest were spat measuring 10-20 mm DVM. The mother oyster culture was progressing well.

Composite sea farming at Valinokkam (CMFRI/IDP/2)

(Sea farming of molluscs, sea cucumber, seaweeds, seabass and prawns)

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Composite seafarming was carried out in the Valinokkam Bay in the Ramanathapuram District of Tamil Nadu. A major achievement was the successful harvest of pearls during the Pearl Festival conducted on 4 May '92 at Valinokkam. Shri. K.C. Lenka, Hon'ble Minister of State for Agriculture inaugurated the Pearl Festival. In this location testing and transfer of technology programme 25 local fishermen participated in the operation of the pearl farm. Out of a total of 9,414 implanted pearl oysters, 7,307 oysters survived and they yielded 1,849 pearls. The fishermen shared a part of the harvest. The pearls produced in this project are being marketed. A total of 11,600 pearl oysters were stocked in the farm; there were 8,000 in the raft and 3,600 in the rack. On 12 June '92 a mishap occurred to the raft due to trawling and 8,000 pearl oysters were lost. On 9 March '93 a total of 2,840 pearl oysters of 20-30 mm length were shifted to Valinokkam for mother oyster culture. The studies indicate that Valinokkam is highly favourable for pearl culture with good growth of pearl oyster, low fouling intenstiy and low mortality compared to Tuticorin Harbour.

Two stakes, each of 10 m length were erected in the Valinokkam Bay in May '92 to test the suitability of the area for the culture of *Crassostrea madrasensis*. Each stake was holding 25 edible oyster strings with 2-month old oyster spat attached to them. In May '92 average weight was 7.1 g and by November they have grown to 40.6 g. Survival in 6 months was 41.6%. Growth was poor when compared to the performance of the species at Tuticorin, and Valinokkam Bay does not seem to be suitable for edible oyster culture.

Data on two growth studies on green mussel *Perna viridis* at Valinokkam

	After 144 days	After 321 days	
1. Initial Lt. mm	39.8	60.7	68.6
Initial Wt.g	6.53	20.8	30.2
	After 30 days	After 60 days	
2. Initial Lt.mm	19.5	30.5	33.1
Initial Wt.g	1.45	3.68	5.1

In the first study the average growth rate was 2.7 mm/month. The growth of the green mussel was low when compared to its growth at Calicut. In mussel culture, moderate production can be expected at Valinokkam.

The growth data of the clam *Paphia malabarica* at Valinokkam

Initial Lt.mm (wt.g)	After 144 days	After 248 days	After 321 days
19.5	21.8	22.9	23.4
(1.45)	(4.0)	(5.0)	(5.5)

Average growth was 0.36 mm/month. Also mortality was considerable. The studies indicate that Valinokkam Bay is not suitable for culture of *P. malabarica.*

The growth and survival of 53 juveniles av. wt. 2.89 g) of the sea cucumber *Holothuria scabra* stocked in cages containing sediment and algal powder, and kept in the Valinokkam Bay were monitored. After 233 days, survival was 46% and the average wt. was 11.6 g indicating 1.12 g/month. Further studies are in progress to culture sea cucumbers in pen enclosures.

Studies on the culture of the seaweed *Gracilaria edulis* at Valinokkam on coir nets of 2 x 2 m and on single rope showed degeneration of the seeded material in 15-30 days during May-December '92. Heavy sedimentation resulting in poor light penetration was the causative factor. However, with clarity of water improved during January-March '93 which suggested that a seasonal seaweed crop could be raised during this period. At the pump house site the plants were growing well while at seabass culture site grazing by fishes was observed.

Two cages of the size 1 x 0.75 x 0.5 m and filled with 7.5 cm sand were erected at 1.5 m depth in the Valinokkam Bay for cage culture of prawns. They were stocked with *Penaeus semisulcatus* (Av. Lt. 63.2 mm) at 27 nos/m^2. The growth data are given below.

	Stocking size	Feed	After 80 days	
			Male	Female
1.	63.2 mm	Clam meat	108.3mm (12.3 g)	108.7 mm (12.0 g)
2.	63.2 mm	Compounded pellets	103.4mm (12.0 g)	110.3mm (13.7 g)

The results were encouraging. Fishermen were involved in feeding the prawns and maintaining the cages.

In seabass culture at Valinokkam difficulties were experienced during April- December in collecting the seed from wild. On 26 January '93 a total of 100 seeds of *Lates calcarifer* (av. Lt. 95.7 mm, av. wt. 13 g) were collected and stocked in a 5 m x 5 m x 2 m cage erected in the Bay. On 9 February '93, seabass seeds numbering 100 (av. Lt. 188 mm, av. wt. 92 g) were stocked in another cage. Daily 10% of the body weight of fish comprising freshly caught sardines and trash fish were given as feed. Fishermen were actively involved in maintaining the cages and in feeding the fish.

Data on the environmental conditions of the Valinokkam Bay indicate typical marine conditions. During May '92- March '93 water temperature varied from 27.0^{0}C to 31.3 ^{0}C, salinity from 30.40-36.80 ppt, dissolved oxygen 3.64-6.49 ml/l. Also data were collected on turbidity, sedimentation and nutrients of the waters of Valinokkam Bay.

FISHERY ENVIRONMENT MANAGEMENT DIVISION

Investigation on environmental parameters in inshore waters in relation to fisheries. (FEM/ES/1.1)

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Under this project technical programmes were implemented at Cochin and other Centers. In the inshore areas off Cochin, sea surface temperature showed two maxima, one in May and the other in November. Bottom temperature was the lowest in the month of August (22.4^{o}C). Surface salinity was at 34 ppt in April-May and decreased to 15 ppt during June-September. Bottom Water values were very low in June at 1 ml/1. Surface chlorophyll *a* values had a maximum in August (12.28mg/m^3) and low during April (0.7-52 mg/m^3). Bacterial counts in surface waters during different months ranged from 26 to 228 x (10^6/ml). In the sediments, the numbers ranged from 11 to 407 x (10^8/g). Total bacterial numbers were high during premonsoon months. The microflora usually belonged to six genera.

Zooplankton biomass showed progressive increase from January 1992 (3.20ml/100 m^3) to reach a peak in October (12.8 ml/100m^3). Though the displacement volume was low in December, the number of fish eggs reached a maximum at 1271/100m^3. In general the zooplankton was observed to be dominated by groups such as copepods, appendicularia, *Lucifer* sp., siphonophores, chaetognaths, hydromedusae and decapod larvae. Blooms of *Noctiluca miliaris* occurred during April and July. *Fragilaria oceanica* occurred in September.

At Mangalore, sea surface temperature was highest in May (34.0^{o}C) and lowest in September (24.5^{o}C). Salinity had a maximum in May (35.45‰) and minimum in August (9.85‰). During September to November the oxygen values at the bottom was low at 1.66 ml/l. Zooplankton volume had a peak in September with blooms of *Noctiluca*.

At Vizhinjam, surface temperature was maximum during May and minimum during August and February. Salinity was in the range 34-35 ppt throughout. Zooplankton peak period was during August.

At Mandapam, surface temperature ranged from 26.5 - 32.0^{o}C in the Gulf of Mannar with salinity in the range 28.46 - 36.12‰. On the Palk Bay side the temperature range was lower 26.0 - 29.1^{o}C and salinity was 28.10 - 35.72‰.

At Tuticorin, sea surface temperature ranged from 24.6 - 30.2^{o}C during the year and salinity ranged from 33.5‰ - 35.8‰. The Dissolved oxygen content was in the range of 3.40 - 5.37 ml/l and pH from 7.47 - 8.09. The zooplankton displacement volume ranged from 7.5 ml (April '92) to 17.5 ml (June '92). Copepods, lucifer, chaetognaths,

stomatopod larvae, fish eggs and larvae were observed in greater numbers during January to March.

Environmental ecology of coastal zone and mapping of potential sites for seafarming (FEM/ES/5)

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Under the above project, ecological parameters of coastal waterbodies were monitored during different seasons at Kayamkulam, Thottappally, Thanneermukkom, Anthakaranazhi, Puthuponnani, Kadalundi, Dharmadom and Korapuzha. At Korapuzha estuary, surface temperature reached a peak in May (32.5^{0}C) and declined to 27.3^{0}C in September and a second peak in November (29.8^{0}C). The lowest temperature of 26.0^{0}C was recorded in December. Salinity values were high during March - April (31.73-33.05‰) and low during June to September (0.14 to 17.41‰). Dissolved oxygen had the lowest value in October 2.98 ml/1. Nutrients such as PO_4 and NO_3 had high values during May to August. Net primary production had two peaks, one in May and the second in October (1.5 and 1.9g C/m^3/day). In other estuaries surface temperature ranged from 27.4^{0}C - 29.5^{0}C. Gross primary production ranged from 0.394 gC/m^3 (Thottappally) to 1.363 gC/m^3/day at Kayamkulam. Salinity values ranged from 9.5‰ at Thottappally to 26.4‰ at Anthakaranazhi.

Monitoring marine pollution in relation to protection of living resources (FEM/MP/1)

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Cochin : Samples for hydrography, sediment and biological materials were collected covering four stations from the estuary to 25m depth zone off Cochin at fortnightly intervals. In the month of July, low oxygen levels, (D.O. at 10m - (bottom), 1.26 ml/1 and 1.03 ml/1 at 20m (bottom) were observed along with high salinity : 10m (bottom), 26.72‰ and 34.19‰, 20m (bottom) respectively. Ammonia levels were invariably higher in the estuarine area (33.41μ g at/1 (surface) and 24.81 μg at/1 (bottom) in May and 37.00 μg at/1 (surface) and 27.22 μg at/1 (bottom) respectively in September). Rather high levels of nitrates were recorded during June (42 - 30 μg at/1) in the estuarine region.

The sediment and biological samples were analysed for heavy metals to monitor their levels in the environment. Metal levels in the sediment showed an increased trend during the monsoon period indicating effect of run off from the riverine areas. (April: Zn:115.25 μg/g; pb: 16.5 μg/g and Cu: 22.50μg/g and June: Zn: 164.0; pb:39.5 and Cu:40μg/g respectively). In the biological samples, compared to fin fishes, metal levels were high in crabs and molluscs. However, these were within the levels recommended for seafoods.

Tuticorin: Regular monitoring of the physico-chemical parameters in the Tuticorin Bay and adjacent waters were carried out to evaluate

the impact of the thermal station discharges on the ecosystem. In the Bay waters the water temperature had a maximum of 34.5°C in May; salinity recorded the lowest value of 10‰ (November) and 36.2‰ in September. The D.O.varied from 3.0 ml/1 in June to 5.2 ml/1 in May. Compared to the open sea, the primary productivity in the Bay was rather low. (eg: 172 mgC/m^3/day in the Bay and 319 mgC/m^3/day in the open sea - September).

Resources assessment of seaweeds and their culture (FEM/SW/1)

V.S.K. Chennubhotla, N. Kaliaperumal, Reeta Jayasankar

Seaweed culture work at Minicoy gave good results with 30 fold increase in weight for the seed material in a period of 71 days. The production rate of different sites were evaluated and an average production of 15 times increase was observed to be feasible. Necessary guidance was given for repeating the sets of experiments for obtaining consistency in production.

At Mandapam, the spore culture of *Gracilaria edulis* has been successful. From the spores liberated from the plant, germlings grow on nylon raphae. After a brief period of nursery phase the germlings are transplanted in cement blocks and allowed to grow in natural environment. The plants grow to about 34cm in 60 days. The work on controlled breeding and rearing of sea cucumbers was continued at Tuticorin. 147 baby holothurians were introduced in a fibre glass tank which was placed and submerged at a depth of 1 metre in Karapad creek for observing their growth. The average weight increased from 5.1 to 5.9 g per month.

Remote sensing and fisheries (FEM/RS/1)

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Under this project, satellite imageries indicating sea surface temperature distribution during different seasons were obtained from NRSA. To verify this data and validate the same, sea truth data were collected at 6 hour intervals along the cruise track of FORV *Sagar Sampada* in the monsoon and postmonsoon cruises. Chlorophyll distribution values were also collected during these cruises at each 1° sq. from lat. 7° 15' N in the Arabian Sea. Processed SST data indicating Potential Fishery Zones supplied by NRSA were passed on to down stream endusers namely, the owners of purse-seiners, trawlers and gillnetters and feed back information have been collected and these are being studied. Participated in the different working group meetings organised by NRSA for developing a data base for marine Remote Sensing Information System. One image analyser and a computer system have since been installed in the Institute.

Fishery oceanography of the offshore regions of the Indian EEZ (FORV/SS/1)

D. Sadananda Rao, G. Subbaraju, V. N.Pillai

FORV *Sagar Sampada* cruises

The Division has under taken dedicated cruises for assessing seasonal changes in biological productivity in the EEZ of Arabian

Sea. During the year one cruise along the southwest coast during monsoon and post-monsoon period were undertaken. Over 120 stations were covered and at each station data on physical and chemical parameters, phytoplankton and zooplankton production was collected. Sea surface temperature was regularly collected at 6 hourly intervals along the path of each cruise for correlating with remote sensing data. Some important observations made during these cruises are given below.

Cruise 100 – Premonsoon (southwest coast): A distinct thermocline was noticed in 100-150 m depth zone with a difference upto 8^0C. Higher values of nitrate was obtained in areas north of Cochin.

Chlorophyll *a* ranged from nil to 2.4 $\mu g/m^3$ indicating low primary production levels. Zooplankton volumes ranged from 7.0 ml to 79.9 ml per 100 m^3.

In April '92, phytoplankton blooms were observed on a vast area between $8^0$06'N and $9^0$30'N and also between 11^0 & 12^0 N during May, probably cased by *Trichodesmium*.

Cruise 102 – Monsoon (North-West coast): SST varied between 28.6 - 26.08^{0}C. Generally high salinity above 36 ppt was observed in surface waters beyond 100m depth zone. Nutrients values generally showed increase from surface to 300 m depth.

Chlorophyll *a* values were high off Bombay and in general ranged between trace to 7.03 $\mu g/l$. Maximum zooplankton volume was recorded off Veraval and Bombay in the shelf waters.

Cruise 104 – Postmonsoon (North-West coast): SST varied between 27.0 - 29.0^{0}C. Salinity values were generally high, over 35.5 ppt except in coastal stations where values ranged between 33.27 - 31.8 ppt. Oxygen values ranged from 5.98 ml/l at surface to 0.161 ml/l at 500 m depth. Nutrients values were low upto 100 m depth and high at 150 - 300 m depth. Higher values were recorded in shallower stations. In the upper water volumes, net primary production averaged at 37 mgC/m^3/day. Zooplankton displacement volumes were high off Bombay and Veraval coasts.

Investigations on zooplankton and components of DSL of the EEZ of India (FORV/SS/3)

K.J. Mathew, T.S. Naomi, N.Gopinatha Menon, K. Prabhakaran Nair, M.P. Molly, V.S. Kakati, M.M. Meiyappan, P.V. Rao.

Sorting of zooplankton samples by engaging contract workers was discontinued. However, this work is continued with the help of available technical staff. The sorting of samples collected during cruise 100 from the EEZ of the S.W. coast is being completed. Simultaneously the data regarding the samples collected have also been gathered from the cruise reports.

Works on planktonic groups namely penaeid prawn larvae, crab larvae, chaetognaths, mysids, cladocera, fish eggs, fish larvae, medusae, ctenophores, pteropods, heteropods and ostracods are being carried out by scientists of the Institute and elsewhere.

Breeding, seed production and sea ranching of sea cucumber *Holothuria scabra* (FEM/CUL/2)

D.B. James

The sea cucumber *Holothuria scabra* was induced to spawn for the first time in the hatchery at Tuticorin. This breakthrough was achieved in 1988 and since then this species was induced to spawn ten times in the hatchery. The seed thus produced is now grown in the sea. Although *H. scabra* forms a fishery in other parts of the world, nowhere the seeds of this species is produced. Another commercially important species *H. atra* has also been induced to spawn for the first time in 1991.

During the period *H. scabra* was induced to spawn two times. More than 20,000 juveniles were produced during the period. The juveniles were transferred to sea after two months when they reached a length of 20 mm. The seed is maintained in velon screen pens and also in one tonne tanks both at Karapad creek and also at Valinokkom Bay. Growth was found to be much faster than the controls kept in the hatchery. It is proposed to give the seed to fishermen to grow them and also to sea ranch the seed to enrich the natural populations.

Conservation and management of coral reef ecosystem (FEM/EE/1)

C.S.G. Pillai

Investigations on the reefs of Kavaratti atoll in Lakshadweep has shown large scale mortality to corals due to many reasons. Examination of Acropora thickets in the lagoon has revealed the presence of white bands in some species which is suspected to be the widespread White Band Disease reported from many parts of the Indo-Pacific resulting in the mortality of corals. The biodiversity of coral species in different reef environment of India is updated.

VESSEL-BASED RESEARCH PROGRAMMES

FORV *Sagar Sampada*

During the year 1992-93, the Institute has undertaken three research cruises off the southwest and northwest coasts of India to study the seasonal variability of biological productivity in the EEZ and to correlate the productivity pattern with the environmental parameters during the premonsoon, monsoon and postmonsoon periods.

R.V. *Cadalmin*

The vessels of this category stationed at seven Research Centres monitored the environmental parameters in relation to the inshore fisheries.

PHYSIOLOGY, NUTRITION AND PATHOLOGY DIVISION

PHYSIOLOGY

Endocrinological factors influencing maturation in some prawns (PNP/39)

N. Sridhar, Mohan, K. Zachariah, A.K.Pandey

The main objective of the project was to find out the different endocrinological factors that are present in the prawns, purify them biochemically to test their efficacy on their maturation and spawning. To achieve this, 10 kg of mature female prawns *P. stylifera* were dissected out, cleared off other contaminating tissues and processed as follows:

The ovaries were processed for lipid residue containing steroids and carotenoids by extraction with different solvent systems such as chloroform - methanol (2:1) and Diethyl ether. The residue obtained was tested for its lipid content (0.1 g residue contains 32.4% lipid). A known quantity of residue was dissolved in ethanol which was further diluted with physiological saline (pH 7.2) to obtain various working concentrations of lipid extract to be used in bioassay experiments.

The air dried ethanol treated thoracic ganglia were homogenised and centrifuged. The protein content of the supernatent was determined (13.58%). The process was repeated for eyestalk extracts and brain extract. (Protein content 4.26% and 2.76% respectively).

A feed was also prepared with mantis Shrimp feeder, groundnut oil cake, soyabean meal, tapioca powder, clam meat, squid meat, supplemented with minerals, vitamins, cholesterol, ovary residue powder and progesterone to feed the animals used in bioassay experiments. Two female *P. monodon* specimens of size 180 mm and wt 40 g were given injections of thoracic ganglia extract and brain extract separately for three days, at the end of which the brain, thoracic ganglia and eyestalks were dissected out and suspended in 3% glutaraldehyde for EM studies.

Studies on cryopreservation of gamets of certain cultivable marine fishes (PNP/43)

A.D. Diwan.

Investigations on long term preservation of sperm motility of certain marine fishes like *Liza parsia, Sillago sihama, Mugil cephalus* and in two species of *Gerrus* were carried out.

Samples of the sperms of *L. parsia* kept in cryopreserved condition (-196^0) for a period of 6 months and above were taken out and thawed and motility was examined under phase contrast microscope. The observation showed the presence of active motile sperms in diluents like 15% glycerine, marine ringer, Alsever and buffer D solutions prepared in combination with DMSO. But the percentage of motile sperms was less and varied among the media used (variation between 20 to 40%). This reduction in the percentage of motility in relation to duration of preservation time was due to a number of factors like damage caused by cryoinjury, less oxygen content in media and high concentration of the sperms used. Hence for improving the

percentage of motile sperms, method of cryopreservation was slightly modified further: (1) oxygen level in the media was increased by releasing more oxygen through oxygen cylinders, (2) volume of media used in each case was increased to five times and the milt quantity was reduced to 50% and (3) standardization of cooling time was carefully adjusted to avoid the damage of cryoinjury.

By using this method the sperm motility was tested once again and the method was found to be superior to the earlier method.

Presently the sperms of *L. parsia* have been kept in cryopreserved condition in the laboratory for testing motility after a period of 6 months and one year using the above modified method.

During the period under report, the motility of cryogenic sperms (-196^{0}C) of fish *S. sihama* was tested after preservation for one month using different cryogenic media. Observation showed that motility of the sperms could be preserved well upto 40% to 50% in marine ringer solution and 15% glycerine. In Alsever's solution motility was around 25%, whereas in buffer B, it was only 5 to 10%. The results indicated that marine ringer and 15% glycerine are good cryogenic media. Another important finding made was that the motility of sperms of *S. sihama* unlike other fishes, can be activated only by using 100% sea water (SW-35%). Use of lower saline water or freshwater however, has no effect on activation of sperm motility.

Investigation was also made on long term preservation of sperm motility in two fish species of *Gerrus (G.filamentosus & Gerrus sp.)*. Observation on sperm motility was carried out for a period of 3 months till the reporting period. The results showed that cryopreserved sperms were highly motile and the percentage of motility approximately was around 50 in both diluents.

Another success was also achieved in preserving the motility of sperms of *M.cephalus*. Milt samples preserved in DMSO along with 15% glycerine and in Alsever's solution at - 196^0 C temperature showed good motility when tested after 20 days.

The sperm morphology of three different fishes *viz; L.parsia, S.sihama* and *M.cephalus* was investigated through scanning electron microscopy (SEM). The studies revealed that the morphological features of the sperms of all the three fishes are similar. The sperms show distinct knob-like head with a long undulated tail. Acrosome formation (a cap like structure) which is a typical character of a mammalian and other vertebrate sperms is found to be absent here. This indicates that the mechanism of fertilization differs in these fishes when compared to other animals.

Tolerance limits of certain environmental factors affecting physiological behaviour of some cultivable organisms (PNP/44)

M. Peer Mohamed, D.C.V. Easterson, D. Kandasami, N. Sridhar, A.K. Pandey

Studies undertaken to measure the tolerance limits in the case of edible oyster *Crassostrea madrasensis* and a clam *Paphia malabarica* to various salinities at a temperature of 25^0 C showed that edible oysters can tolerate wide range of salinities (20 to 45‰) but they grow well only within the salinity limits of 25 to 35‰, while *P. malabarica* was found to be very much sensitive to salinity changes (optimum range of salinity for best survival and growth is found to be 20-25‰).

NUTRITION

Farm trials of compounded feeds developed for prawns (PNP/35)

R. Paul Raj, M.Vijayakumaran, D.Kandasami, Manpal Kaur, P.Vijayagopal

(1) Improvement of quality of the farm-stead feeds:

Fish meal and dry fish samples used in feed preparation in Nellore District showed high levels of acid-insoluble ash (12-16%); sodium chloride (9-12%) and moisture content (16-20%). Farmers were taught the judicious selection of good animal protein sources in order to improve the quality of the farm-stead feeds.

(2) Performance of indigenous and imported commercial feeds and farm-stead feeds:

Data collected in order to assess the performance of indigenous and imported commercial feeds and farm-stead feeds showed the indigenous commercial feeds are as effective as imported feeds for extensive farming in terms of growth, production, feed conversion ratio and economics (production ranging from 1-2 tonnes/ha/crop in most extensive farms and profit by 20-30%). The farm-stead feeds, on the other hand gave profits in the range of 20-50% higher than the imported feeds.

(3) Factors affecting feed efficiency in culture systems:

Evaluation of data collected from several farms in Nellore showed that proper selection of feed ingredients, proper feed particle size, judicious feeding and water quality management improved the feed conversion rates (1-1.8).

(4) Culture of *Penaeus indicus* and polyculture of *Penaeus monodon* with Indian major carps in low-saline waters:

P. indicus was cultured in a 5 ha farm (each pond of 1 ha area) at Gangapatnam where low salinities (10 ppt) prevailed for a greater part of the crop (July–December) and a production of 1.2–1.8 tonnes/ha/crop of 4 – 5 months duration and FCR ranging from 1.6 – 1.8 were obtained. Success was also achieved in the polyculture of *P. monodon* with rohu and catla in a few low saline (0-6 ppt) coastal ponds in Nellore district.

(5) Environmental characteristics of prawn culture system:

Environmental characteristics of prawn culture systems were studied by monitoring atmospheric and water temperature; water and soil pH; salinity and dissolved oxygen in some selected prawn farms at Uttukur, Gangapatnam, Ramudupalam, Koruttur and Krishnapatnam in Nellore. As dissolved oxygen was the critical factor in extensive culture systems, lower stocking *(P. indicus* 70,000/ha and *P.monodon 40,000/ha)* and improved water exchange recommendations proved beneficial in most cases.

Swarms of rotifers, mysids, copepods and phytoplankton blooms were observed in several ponds where low DO levels were encountered. Farmers were advised the rational use of feed and fertiliser and water exchange for prevention of excessive blooms.

(6) Disease monitoring:

Disease monitoring showed reduced growth, passive movement and mortality of prawns on several occasions in one farm

adopting semi-intensive culture. The prawns on examination showed the gills choked with fine silt/feed particles, filamentous bacteria, fungi, epizootics like *Zoothamnium* and other protozoans. Cotton shrimp, a protozoan infestation was recorded in two *P. indicus*. Immediate harvest of the pond was advised in order to prevent the disease spreading to other ponds.

Farm trials with compounded feed at Narakkal and Chellanam:

Small scale farm trials conducted with *P. indicus* in a 422 m^2 pond at Narakkal with compounded feed comprising of soyabean meal, cuttlefish meal, fish meal and prawn head waste as the protein sources and an overall protein content of 36.40 recorded an increase in live weight ranging from 71.96--100.89% for the experimental animals over a live weight of 50.37% for animals not fed with any supplementary feed. Another field trial was carried out at Chellanam in a coconut grove pond (10 cents area) stocked with 3500 nos. of *P. indicus* post larvae *(av.lt. 6mm, wt. 6.9 mg)*. After 90 days of rearing on a compounded feed comprising of fish-meal-10%, prawn-head waste-20%, ground-nut oil cake-15%, squid waste-10%, soya flour-10%, sardine oil-3%, soya oil-3% and tapioca powder 20%, 30 kg of prawns were harvested with a recovery of 98% and feed conversion rate of 1.12.

Proximate composition of Nellore feeds:

Water stability and proximate composition of four pelleted feeds and one moist feed from Nellore were determined. Moisture content ranged from 9.3–30.33; protein from 36.34-40.79; lipid 3.15-0.73; fibre 1.11-3.26; ash 14.05-17.56 and NFE 41.11-53.08% respectively. Water stability tests showed all the feeds to be stable upto 5 hours of immersion in water with dry water loss ranging from 12-14% after 5 hours.

Digestibility studies:

Digestibility trials of feeds compounded with graded levels of squilla meal were concluded and data is being processed. Water stability of the feeds showed a 2-4% loss in dry matter after 1 hour of immersion in water. From 2-6 hours a further loss in dry matter of about 2% was observed.

PATHOLOGY

Disease investigation and disease control in culture systems (PNP/37)

K.C.GEORGE

During the period, cell free extracellular toxic products of *Aeromonas salmonicida* were prepared. These products were injected to *Etroplus maculatus* and the toxic effect was recorded. 0.1 ml of saline washings of ECP produced abnormal swimming behaviour and death within 4 hours.

Visits were made to places like Muhamma, Mannacherry, Alleppey, Thotapally, Alwaye etc. where EUS has occurred in the previous year. The enquiries revealed occasional cases of EUS, occurrance among fishes particularly during early monsoon. Several fishes were caught and examined for lesions. A few catfishes of species *Heteropneustes* sp. revealed haemorrhagic spots on ventral side of abdomen. Bacteriological isolations from fishes yielded gram negative motile bacteria, *Aeromonas hydrophilia*. They were oxidase and catelase positive and capable of liquifying gelatin. They were indole negative. During this period, reports

were obtained from Kuttiyadi region of Calicut district and Irutty of Kannur District where new out-breaks occurred. Disease outbreak also occurred in Cochin backwaters. Brackishwater species like *L.parsia* and *M. cephalus* were severely affected.

GENETICS

Identification of genetic stocks in Indian Mackerel *(Rastrelliger kanagurta)* (PNP/41)

M.K. George, P.C. Thomas, I.D.Gupta, N.K. Verma

The two objectives of the project were the study of biochemical genetic polymorphism in populations of mackerel from different regions and identifications, if present, genetically different stocks that are sustaining the present fishery. An electrophoretic screening of seven enzyme systems in selected tissues of mackerel revealed polymorphism at loci controlling glucose-6-phosphate dehydrogenase (G6PD), Xanthine dehydrogenase (XDH), alcohol dehydrogenase (ADH), Peroxidase (PO), aldehyde oxidase (AO), and monomorphism at lactate dehydrogenase (LDH) and isocitric dehydrogenase (IDH) loci. All these five polymorphic enzymes except XDH were found to be under the control of two diallelic loci where as XDH appeared to be under the control of a single diallelic locus. The allelic frequencies at all these loci were estimated in sample populations from Cochin, Thotapally and Mangalore. A comparison of these values at 11 loci indicated differences at certain loci between populations. A comparison of values of genetic identity and distance also showed apparent differences between populations. Further, detailed studies are in progress to draw a conclusion on the population genetic composition of the mackerel *R. kanagurta*.

TRAINING

Trainees in Seaweed culture collecting seaweeds from the intertidal region of the lagoon in Minicoy.

WOMEN IN AGRICULTURE DAY

"Women in Agriculture Day" celebrations at KVK, Narakkal. Group Discussion on culture technology.

FARM TRIALS

Farm trials with compounded feed developed by the Institute were carried out in a 10 cent pond at Chellanam; 3,500 seed of *Penaeus indicus*, stocked yielded 30 kg. after 90 days.

VISITORS

Shri K.C. Lenka, Hon'ble Minister of State for Agriculture, DARE/ICAR/ Animal Husbandry and Dairying on a visit to the Institute Headquarters at Cochin is going round the Computer Centre.

Visit of Parliament Consultative Committee to the Institute.

ICAR SPORTS

Dr. P.S.B.R. James, Director, introducing the Athlets to Dr. A.M. Michael, Vice-Chancellor, Kerala Agricultural University, on the inaugural day of the ICAR Inter Institutional Sports Meet for Zone IV hosted by CMFRI at GCDA Stadium, Cochin, 5 - 9 November '92.

SOCIO-ECONOMIC EVALUATION & TECHNOLOGY TRANSFER DIVISION

Study on economic performance of trawlers (FE & E/24.1)

D.B.S. SEHARA, K.K.P. PANIKKAR

The project was formulated to carry out survey of trawl units operating at selected centres in Kerala, Karnataka, Orissa and West Bengal. Data collection on catch, price, cost and employment in relation to trawler was initiated at four centres namely Balaramagudi Digha, Paradeep and Sakthikulangara. Survey in Karnataka could not be undertaken due to shortage of T.A. funds. Collection of data and the analysis is in progress and is likely to be completed by March '94.

The earlier data collected under trawl project (DF/IP/I) from the selected centres have been analysed and the report is under print.

In Andhra, the medium trawler of 12-15 m OAL had an acquisition cost of Rs. 7.7 lakh in 1991 which resulted in a fixed cost of Rs. 2.62 lakhs per annum. The fixed cost of small trawler of 8-10 m OAL, which had an initial investment of about Rs.3.9 lakhs, is calculated at Rs.1.42 lakhs per annum. The total annual fishing cost of a medium trawler was Rs. 10.14 lakhs and that of a small trawler Rs. 6.42 lakhs.

The annual profit earned by a medium trawler was Rs. 1.79 lakh and small trawler Rs.0.77 lakh. The initial investment on both types of trawlers could be recovered within 3 years. The rate of return to the capital is worked out at 38.3 per cent for medium trawlers and 34.8 per cent for the smaller ones. Thus, based on the various economic efficiency parameters, it can be safely concluded that both types of trawlers under study were running in profit during 1991. The medium trawlers were found to be economically more efficient. In no case further addition of the fishing fleet is advised.

Comparative economic efficiency of gillnet fishing units in Tamil Nadu (FE & E/24.2)

R. SATHIADAS

The costs and earnings data collection for the sample fishing units at Madras and Tuticorin has been continued and the analysis of data for the quarter October-December 1992 has been completed. Both one day fishing and two day fishing were carried out by gillnetters in Madras region. For one day fishing units, the average catch per trip worked out to 106 kg, realising a gross revenue of Rs. 2,096 as against the operational expenses of Rs. 1,275. For two day fishing units, the catch per trip was 120 kg realising a gross revenue of Rs. 3,600 as against the operational expense of Rs. 2,695 per trip.

At Tuticorin, the plank built boats operating gillnets recorded poor catch and revenue. The average catch per trip was 16 kg with gross revenue of Rs. 220 as against operational expenses of Rs. 153.

Studies on the efficacy of village adoption in transfer of technologies (ToT) in marine fisheries (FE & E/26.1)

A. Regunathan, M.M. Thomas

During the year under report, ward Nos-VIII and IX in Narakkal village were surveyed and 28 farmers were identified as beneficiaries to receive different input/service proposed to be given to the target population. Imputs such as prawn seeds, fish seeds, sluice gates, vegetable seeds and koel were planned to be supplied to the farmers free of cost. Services like eradication along with professional services were planned to be extended to the identified farm families.

5500 seeds, of mullets (5000) and *Mugil cephalus* (500,) were distributed to five selected farmers in the area. A growth of 100-150 mm for mullets (wt. 40-50 gm) and 280-310 mm for *M. cephalus* (Wt. 700-750 gm) was recorded during a period of 7 months. Two farms experienced flooding and it appeared that some stock have escaped the farm. However, the growth has been observed to be good in their farms.

Empowering rural women through extension education - An action research in fishing village (FE & E/26.2)

Krishna Srinath

Time series data on the living conditions of fishermen with special reference to women from 25 fishing households each from 3 centres namely north Chellanam, south Chellanam and Fort Cochin were collected for 10 days per month from July to March.

Information was collected on women's role in collection of clams, prawn seed handpicking of fish and cast net fishing.

Matsyamahilavedi, a fisherwomen society, consisting of about 200 members at south Chellanam was adopted for conducting the study.

The technology for prawn culture developed at the Institute was transferred to women by demonstrating the same in a ten cent canal. The feed developed at the Institute was also tested in the same field. A quantity of about 30 kg of prawns was harvested in a period of 90 days. A group discussion on the technology was organised.

The technology for poultry rearing was extended to 20 families by distributing 20 chicks each supported with technical information and involvement of voluntary agency.

The target women participated in different fishery related exhibitions. They were also involved in discussions with different fishery officials.

Investigations of the impact of motorisation of country craft on marine fishery along Kerala coast (IDP/3)

K.K.P. Panikkar, D.B.S. Sehara, K.S. Scariah

During the period under review, data have been collected from all major motorised craft gear combinations *viz.*, ring seine, disco net, hooks and lines, mini trawl and gillnets.

The changing pattern of traditional fishing operation due to motorisation is reflected in the introduction and further development of ring seine operation. Before the introduction of motorisation large plank built boats were used mainly in central Kerala that too for *Thanguvala* operation. But along northern Kerala coast, only small dugout canoes were used and for boat seines like *Pattankollivala* 4 small canoes were used to operate in

one unit. With the advent of ring seine operation, now bigger type plank built boats are used in north Kerala, which can accommodate 30-35 workers. Some such units operate with two 40 HP engines and the carrier boat with 25 HP engine. Thus, the investment requirement of a ring seine unit has very much increased especially in northern part of Kerala. However, for other types of gears, mostly engines of 12 HP and below are used.

Regarding the economics of operation, an average revenue per day of operation of a ring seine is worked out at Rs. 6,000 and the total cost at Rs. 4,500 leaving a net profit of Rs. 1,500.

In the case of gillnet units there are wide variations in the revenue as well as cost of operation at different centres. For example, at Puthiangadi average catch per day is estimated as 300 kg with a total revenue of Rs. 3,300 against an operational cost of Rs. 2,200. Whereas, at Munambam, the average catch per day is only 90 kg with an income of about Rs. 1,400 at a total cost of Rs. 1,000.

The average revenue per day of operation of hooks and line unit comes to Rs. 2,600 with a net income of Rs. 1,100.

With the introduction of O.B.E, mini trawl operation is becoming popular among traditional fishermen. The data collected from few centres indicated that the average catch was comparatively low *ie.*, about 40 kg per day of operation and the value realised was Rs. 1,600. The net profit was about Rs. 700 per day of operation. Most of the mini trawls use 7 HP engines and the initial investment was also less. Hence this unit has become popular among the fishermen now-a-days.

The disco net used along the Kerala coast is only a small version of the ring-seine. This unit has been taken separately for the study mainly to find out the advantage of using ring seines with lesser HP engines.

From the preliminary analysis it has been observed that the economic benefit is more for smaller units. However, it can be confirmed only after further detailed analysis.

The data collection from some of those units could not be covered for one full year due to various reasons. Efforts are on to complete data collection by October '93.

LIBRARY AND DOCUMENTATION SECTION

During the year under report 78 books and 2011 issues of journals were added to the library at Headquarters. Essential books and periodicals were also acquired for the libraries at the Mandapam Regional Centre and at all the Research Centres. Inter-library collaboration and inter-library loan of publications were continued. Reference facilities were provided to visiting Scientists, Scholars and students of various universities, institutions, etc. from within and outside the country.

The mimeographed "Current Awareness Service" was continued to be issued. The library also stocks, distributes and sells the Institute's publications.

The following publications were issued during the year.

1. CMFRI Special publication Nos. 50, 51 and 52
2. CMFRI Bulletin No. 45
3. Proceedings of the National Conference on Tunas, April 1989, Cochin.
4. CMFRI Newsletter No. 54 and 55
5. Marine Fisheries Information Service T&E Series Nos. 113, 114, 115, 116 and 117
6. Research Highlights 1991-92
7. CMFRI Annual Report 1991-92
8. The Indian Edible Oyster - Brochure
9. The Indian Marine Pearls - Brochure

POST-GRADUATE PROGRAMME IN MARICULTURE

Ph.D. Programme

The following Senior Research Fellows were awarded Ph.D. Degrees by the Cochin University of Science and Technology for their work on:

1. Ecological characteristics of prawn culture fields in the Cochin area.... Sheeba Susan Mathews (Supervising Guide - Dr. N. Gopinatha Menon).
2. Studies on biochemical genetics of the grey mullet, *Mugil cephalus* Linnaeus.... S. Vijayakumar (Supervising Guide - Dr. M.K. George).
3. Heterotrophic bacterial activity in selected aquaculture systems near Cochin .... Santhi Thirumani (Supervising Guide – Dr. (Mrs.) V. Chandrika).
4. Growth and reproduction of the penaeid prawn *Metapenaeus dobsoni* (Miers) in brackishwater environment ....C. Vasudevappa (Supervising Guide - Dr. C. Suseelan).
5. Studies on the effects of steroid hormones on the growth and biochemical composition of the mullet *Liza parsia* (Hamilton)..... Bhaskar Laxman Jadhav (Supervising Guide – Dr. R. Paul Raj).

M.Sc. Programme

All the ten Junior Research Fellows of the 11th batch who have appeared for the M.Sc. Degree Final Semester Examination held in November 1992 have passed in first class, two with distinction.

The Mariculture Degree holders are in great demand and are selected by private firms even while they are doing the course. It is understood that 5 of them got ARS; 3 of them are employed in MAGUNDA FIRMS, Nellore; 2 in THAPPER GROUP, Nellore; 1 in HINDUSTAN LEVER Ltd., and 3 in ITC, Tuticorin during the year.

KRISHI VIGYAN KENDRA

Courses conducted under K.V.K., Narakkal

Sl. No.	Subject	Short term training (Below one month)			Long term training (Above one month)			Total	
		No. of courses	No.of trainees Males	Females	No.of courses	No.of trainees Males	Females	Cour-ses	Partici-pants
1.	Fisheries	9	55	126	–	–	–	9	181
2.	Animal production	7	–	165	–	–	–	7	165
3.	Crop production	15	110	320	–	–	–	15	430
4.	Home science	12	–	196	–	–	–	12	196
	Total	**43**	**165**	**807**	–	–	–	**43**	**972**

The type of trainers trained were, practising farmers (74), youths (91) and farm women (807).

Demonstration of various aspects of farming and other related subjects were also taken up by the Kendra as follows:-

Sl. No.	Item of Demonstration	No.	Area	No.of participants
1.	Prawn seed collection	8	Surf region and canals in Vypeen island	166
2.	Eradication of predators from the culture fields	6	0.2 ha	117
3.	Vegetable cultivation	3	KVK Campus	62
4.	Nutrition garden	1	KVK Campus	22
5.	Pest control (preparation of bordeaux mixture)	7	Off campus	206
6.	Fruit preservation	3	KVK Campus	68
7.	Handicraft	3	KVK Campus	30
8.	Labour saving device	1	KVK Campus	15
	Total	**32**		**686**

In addition to the regular training and demonstration programmes, the Kendra provided training to the farmers sponsored by the Brackishwater Fish Farmers Development Agency on prawn farming.

The projects submitted by the farmers to the banks for financial assistance are evaluated and the Kendra has linkages with State and Central organisations connected with agriculture, fisheries and related fields. Six villages and 357 families were surveyed to identify their

specific training requirements. Trained farmers have taken up prawn farming by way of self employment and some of them are employed in private farms. Prawn seed hatcheries, both in the private and public sectors have come up. The KVK has been advocating the feasibility of taking two harvests, each of three months duration, which can produce 2500 kg/ha/yr of tiger prawns valued at Rs. 5 lakhs.

The staff of KVK were also associated with two projects of the Institute. 1) Studies on the efficacy of village adoption in transfer of technologies in Marine fisheries. A production of 450 kg/ha of white prawn was obtained in 3 months from hitherto unutilised areas in between coconut groves. 2) Empowering rural women through extension education - an action research in fishery village. A production of 400 kg/ha of white prawn was harvested in 92 days from homestead ponds.

Training achievements of the Trainers' Training Centre

Sl. No.	Subject	No.	Duration (days)	No. of persons trained		
				Men	Women	Total
1.	Prawn farming	2	10	14	–	14
2.	Hatchery production of Marine prawn seeds	1	15	13	–	13
3.	Post-harvest technology in fisheries	1	10	5	2	7
4.	Seaweed culture and utilisation	2	10	18	–	18
5.	SCUBA diving	1	45	9	–	9
6.	Edible oyster farming	1	8	4	–	4
	Total	**8**		**63**	**2**	**65**

The type and number of demonstrations carried out by the TTC were as follows: Prawn seed collection (3), Eradication of predators (2), Prawn farming (2) and Fish processing (4). The number of participants in the above programmes were 27, 14, 14 and 7 respectively.

Extension activities taken up by the KVK/TTC

Sl. No.	Name of activity	No.	No. of participants
1.	Film show	15	1475
2.	Radio talk	2	–
3.	World Nutrition day	1	65
4.	Women in Agriculture day	1	75

OFFICIAL LANGUAGE IMPLEMENTATION

The OLIC programmes of the Institute were implemented as per Annual Programme 92-93 for progressive use of Hindi and instructions issued in this regard from time to time from the Departments concerned.

The OLIC meetings held at Headquarters and subordinate centres have reviewed the Hindi activities and co-ordinated the decisions.

Continued the bilingual issue of sections 3(3) documents and reply of Hindi letters in Hindi itself. In Hindi correspondence marginal increase of 3% was made.

The quarterly reports on Hindi received from the 12 subordinate centres were compiled and forwarded to ICAR. Report for the Cochin office was prepared separately and forwarded to the Regional Hindi Implementation office, Ministry of Home Affairs, Cochin. Regular review of the consolidated reports was conducted at the OLIC meetings held at Cochin. Reviews were conducted on the outstations report and suitable guidance were given.

Under the Hindi training one Jr.Clerk at Cochin has passed the Hindi typewriting course. During the year, the number of officials who have passed the Hindi course were: Pragya-10, Praveen-6 and Prabodh-25.

During the year 3 sessions of Hindi workshop were organised, one each for Ministerial, Technical and Scientific categories. Total 42 members participated. Course materials and reference books were issued. In order to motivate the use of Hindi, workstudy and feed back study were conducted. Hindi workshop was organised at the Vizhinjam centre. The A.D(OL) has also provided faculty assistance to other central government offices and autonomous bodies at Cochin.

Hindi Week was celebrated at Cochin from 14–19th September with various competitions. Prizes and certificates were issued to the winners in the valedictory function held on 19th September . Hindi week was celebrated at various Research Centres and Mandapam Regional Centre of CMFRI.

Dr. P.S.B.R. James, Director; Shri. C. Muralidharan, A.O. and Smt. Sheela, A.D. (OL) inspected the Hindi Implementation activities at various research centres.

Issues of MFIS Nos. 117–120, News Letter No. 56 and Research Highlights 91-92 were published bilingually. Summary of Annual Report 1991-92 published with Hindi summary. 19 new Hindi books were added to Hindi Library and continued the subscription of periodicals.

LONG TERM PERSPECTIVE PLAN FOR R & D IN MARINE FISHERIES

The Institute has prepared a document 'Long Term Perspective Plan for Research and Development in Marine Fisheries' which is now under the consideration of ICAR. The document includes the following 9 major thrust areas:

1. Management of exploited fishery resources;
2. Exploitation and management of fishery resources of the EEZ beyond 100 m;
3. Studies on Island ecosystems;
4. Conservation of marine resources and ecosystems;
5. Coastal zone management;
6. Augmenting production through sea farming;
7. Basic studies on Physiology, Nutrition, Pathology and Biotechnology of cultivable marine animals;
8. Post-graduate education in Mariculture - Establishment of a Central Fisheries University at Cochin;
9. Extension education, Technology Transfer and Training.

CONSULTANCY

The Institute has taken up a consultancy for the Bharathi Vidya Peeth, Pune, to establish a prawn hatchery at Srivardhan in Maharashtra at a cost of Rs. 2,06,227.

A consultancy work is underway to monitor the water quality in connection with the South End Reclamation Project for Cochin Port Trust at a cost of Rs. 1,00,000.

EXPERT COMMITTEE ON ASSESSMENT OF FISH WEALTH

Dr. P.S.B.R. James, Director, CMFRI, Cochin, has been nominated by the Government of Kerala to lead the Expert Committee on Assessment of Fish wealth during Trawl Ban and Non-ban period, along the Kerala coast.

EXPERT COMMITTEE TO STUDY FISH DISEASE IN KERALA

Dr. P.S.B.R. James, Director, CMFRI, Cochin has been appointed as the Chairman of the Expert Committee to study the causes and preventive measures of the fish disease, Epizootic Ulcerative Syndrome.

CMFRI SCIENTISTS SERVED IN FISHERY EXPERT COMMITTEE

Dr. K. Alagaraja, Principal Scientist, Dr. C. Suseelan, Senior Scientist and Shri. M. Srinath, Scientist-SG of the Institute have been appointed to the Expert Committee constituted by the Government of Kerala in April 1992 to go into the problem of ban on monsoon trawling along Kerala coast and advice the Government suitably. The Committee submitted its report to the Hon'ble Minister of Fisheries, Govt. of Kerala on 3rd June, 1992.

DEPUTATIONS

Dr. P.K. Krishna Kumar, Scientist. Deputed to Seattle, USA from 28 May 1992 to 27 May '93 to avail Biotechnology Overseas Award 1991-92.

Shri. S. Kalimuthu, Technical Officer (T-5) and Shri.J.R. Ramalingam, Technical Assistant (T–1–3) were deputed to Bangkok to participate in a training/workshop on the taxonomy and processing of red seaweed, 21–28 April '92.

COLLABORATIVE/SPONSORED RESEARCH PROGRAMMES

1. Pilot Project on Oyster culture - Partially funded by NABARD. Rs. 6.44 lakhs.
2. Survey and assessment of Marine Ornamental Fishes of Lakshadweep. Rs. 24.8 lakhs, funded by the Dept. of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India.
3. Intensive seed production and sea ranching of sea-cucumbers. Financed by MPEDA. Rs. 6 lakhs.
4. Hatchery production of clams and ranching them in coastal waters. Financed by MPEDA. Rs. 3.62 lakhs.
5. Genetic studies on marine penaeid prawns. Funded by USIF Rs. 24. 81 lakhs.

AWARDS

It is noteworthy that the 'INDAQUA - 93' organised by MPEDA at Madras, 19-23 March '93, the following scientists of this Institute were honoured with awards for their outstanding contributions to the field of aquaculture development.

Dr. P.V. Rao	PS	(Breeding of flower prawn)
Dr.K.A. Narasimham	PS	(Clams)
Dr. V.S.K. Chennubhotla	PS	(Seaweeds)
Shri. R. Marichamy	PS	(Mud crab)
Dr. N.N. Pillai	Sr.S	(Prawn breeding)
Dr. D.B. James	Sr.S	(Sea cucumber)
Dr. C.P. Gopinathan	Sr.S	(Diatom culture)
Shri. M.E. Rajapandian	S(S.G.)	(Edible oyster)
Dr. P.S. Kuriakose	S(S-3)	(Green mussels)
Dr. Paul Raj	Sr.S	(Shrimp Feed)
Dr. E.V. Radhakrishnan	Sr.S	(Lobster)
Dr. M. Vijayakumaran	Sr.S.	(Lobster)

ENGAGEMENTS

Dr. P.S.B.R. James, Director attended the following:

The Workshop on Commercialisation of Biotechnologies in Agriculture and Aquaculture, Ahmedabad, 23 April '92.

National Seminar on Endangered Fishes of India at NBFGR, Allahabad, 25-26 April '92.

Delivered a lecture in the Dept. of Zoology, Banaras Hindu University, Varanasi, 27 April '92.

The Pearl Festival and inauguration of Composite Seafarming Project by Shri. K.C. Lenka, Hon'ble Minister of State DARE/ICAR at Valinokkam, Ramanathapuram District, 4 May '92.

The ICAR Scientific Panel for Fisheries Meeting at New Delhi, 7 May '92.

Accompanied the Director General, Dr. V.L. Chopra ICAR from Madurai in connection with his visit to Tuticorin Research Centre and Mandapam Regional Centre.

The Workshop on Utilization of Coastal Environmental Maps organised by Space Application Centre and Centre for Earth Sciences Studies at Trivandrum 27 May '92.

The Brain Storming Session to discuss efficacy of SST forecast at Ahmedabad, 23 June '92.

The Meeting of Directors of ICAR Institutes convened at Council to discuss matters/problems common to ICAR Institutes, at New Delhi, 13 August '92.

The Planning Commission Group discussion to examine issues involved in development of Deep Sea Fisheries on 25th September '92.

The High Power Committee Meeting on Integrated Fisheries Development in Kerala State at Trivandrum, 19 October '92.

Colloquium on Tuna Research, 11-12 November,'92, Cochin, organised by FSI.

The Workshop for Policy Makers on the Conservation and Sustainable Management of Biological Diversity at Madras, 19-20 December '92.

The Meeting with the Secretary (Production and Supplies) regarding R.V. *Skipjack* at New Delhi, 30 December '92.

The Kendriya Vidyalaya Management Committee Meeting at Mandapam Camp, 21 January '93.

FAO/DANIDA/GOI Workshop on Bio-economics of Indian North East Coast Fisheries at Visakhapatnam, 8-10 February '93.

The 'INDAQUA 93' organised by Marine Products Export Development Authority at Madras, 19-23 March '93.

The Edible Oyster Harvest Mela and Group discussion on Shellfish farming, processing and marketing at Tuticorin, 27 March '93.

Dr. M. Peer Mohamed, Principal Scientist, participated in the course on "Agricultural research project management" at NAARM, Hyderabad, 21 April to 1 May '92.

Dr. M.M. Thomas, Officer-in-Charge, KVK and **Shri K.N.R. Kartha**, Techincal Officer participated in the Seminar "Traditional prawn farming - problems and prospects" organised by the Fishery Society of Kerala at Cochin, 12 May '92.

Dr. G. Luther, Dr. K. Alagaraja, Shri. K.V.N. Rao and Dr. A. Noble, Principal Scientists; **Dr. C. Suseelan and Dr. N.G.K. Pillai**, Sr. Scientists attended the National workshop on development of marine fisheries of higher productivity and export, organised by Ministry of Agriculture, Dept. of fisheries, Govt. of Kerala at Cochin, 9-10 June '92.

Dr. (Mrs) Krishna Srinath, Sr. Scientist participated in the Seminar on 'Population Education' at Chellanam in connection with World Population Day and gave a talk on 'Population trend in rural communities', 11 July '92.

Dr. V. Sriramachandra Murty, Sr. Scientist gave a lecture on "Marine Fisheries" at the Technical programme on fisheries organised by State Bank Institute of Rural Development, Hyderabad, at Kakinada, 2 August '92.

Dr. M.K. George and Dr. P.C. Thomas, Sr. Scientists; and **Dr. N.K. Verma**, Scientist attended the "Seventh meeting of the Committee on introduction of exotic aquatic species" organised by National Bureau of Fish Genetic Resources, Allahabad, held at CMFRI, Cochin, 24 August '92.

Dr. V.S.K. Chennubhotla, Principal Scientist attended the Workshop on 'Management of Agricultural Research Stations' held at NAARM, Hyderabad, 22-25 September '92.

Dr. G. Luther, Principal Scientist; **Dr. G. Sudhakara Rao, Sr. Scientist; Shri. Y. Appanna Sastry**, Scientist S.G; **Shri. S. Reuben**, Scientist S-3; **Shri. K. Vijayakumaran**, Scientist and **Shri. C.V. Seshagiri Rao**, Technical Officer attended the meeting of Forum of Fisheries Professionals at Visakhapatnam, 30 September '92.

Dr. P.P. Pillai, Principal Scientist; **Dr. N.G.K. Pillai**, Sr. Scientist and **A.A. Jayaprakash**, Scientist S.G. participated in the 'Colloquium on Tuna Research', Cochin, organised by FSI, 11-12 November '92.

Dr. G. Sudhakara Rao, Sr. Scientist gave a talk on 'The problems and prospects of the prawn fishery along the northeast coast of India' at the meeting of Forum of Fisheries Professionals, Visakhapatnam, 23 December '92.

Dr. G. Luther, Principal Scientist; **Dr. G. Sudhakara Rao, Dr. C. Suseelan, Dr. V. Sriramachandra Murty and Dr. Syda Rao**, Sr. Scientists; S/Shri. **M. Srinath, R. Sathiadas, D.B.S. Sehara and K. Balan**, Scientists S.G. participated in the FAO/DANIDA/GOI Workshop on Bio-economics of Indian North East Coast Fisheries at Visakhapatnam, 8-19 February '93.

Dr. P.P. Pillai and Dr. P. Bensam, Principal Scientists, attended th FORV *Sagar Sampada* Inter-Agency Workshop, Cochin, 1-2 March '93.

Dr. K.A. Narasimham, Principal Scientist participated in the Edible oyster Harvest Mela at Tuticorin, 27 March '93.

Dr. P. Bensam, Principal Scientist served as a Member-Convenor of the Working Group to study the stock position of the silver pomfret, constituted by the Govt. of India, Ministry of Agriculture.

Attended the 11th meeting of the Consultative Group for the Cochin Zonal Base of the Fishery Survey of India.

Attended the 17th meeting of the Consultative Group of the CIFNET, Cochin.

Dr. K. Satyanarayana Rao, Principal Scientist gave a special lecture on World fisheries, Marine fisheries of India and Mariculture of molluscs at the Zoology Research Laboratory, University of Madras.

Dr. R. Paul Raj, Sr.Scientist served as a Guest Professor and delivered a lecture on Aquaculture in the Mangrove Zones in the International Training Programme on Mangrove Genetic Resources organised by the M.S. Swaminathan Research Foundation, Madras, May '92.

Delivered a lecture on 'Feeds and feeding strategies in prawn culture' at the Training programme on prawn culture organised by the small Industries Service Institute, Ministry of Industry, Govt. of India at Madras.

Delivered a lecture on 'Shrimp farming in the coastal zone' at the Training programme organised by the NABARD to Bank Officers at Madras.

Delivered a talk on the 'Present status of shrimp feed manufacturing scenario in India' at the Seminar on shrimp feed organised by the US Wheat Associates and MPEDA at Madras, 19 March '93.

Served as a Councellor for 'Shrimp feed mill' at the 'INDAQUA 93' at Madras, 21-23 March '93.

Delivered special lectures during March '93 to the M.Sc Zoology students of the University of Madras on: 1) Nutrition in aquaculture and 2) Feeds and feeding in aquaculture.

Smt. P. Geetha, Junior Library Assistant, was deputed for undergoing three day full-time "Refresher Programme on Informetrics", 24-26 June '92 at Bangalore.

VISITORS

Cochin

Dr. Buddy L. Jensen, U.S. Fish and Wildlife Service, Dexter National Fish Technology Centre for endangered fishes, 21-22 April '92.

Shri. K.C. Lenka, Hon'ble Minister of State for Agriculture, DARE/ICAR/Animal Husbandry and Dairying, New Delhi on 31 August '92.

Parliament Consultative Committee of Ministry of Agriculture, on 2 November '92.

Dr. A. Firozy, Senior Fisheries Officer, Fisheries Dept. of the Islamic Republic of Iran.

Mandapam Camp

Shri. K.C. Lenka, Hon'ble Minister of State for Agriculture, DARE/ICAR/Animal Husbandry and Dairying, New Delhi.

Dr. V.L. Chopra, Director General, ICAR and Secretary, Dept. of Agriculture Research and Education, Govt. of India, New Delhi.

Dr. M. Devaraj, Dean; Shri S.M. Justin, Engineer and Dr. N. Sukumaran, Fisheries College and Research Institute, Tuticorin.

Shri. Kuldip Rai, Dy. Secretary, Ministry of Home Affairs, Govt. of India, New Delhi.

Shri. J.N. Prasai, Jt. Director of Employment Exchange, Ministry of Labour (DGE & T), New Delhi.

Shri. N. Janardhan, District Collector, Ramanathapuram.

Dr. K.L. Varma, Director (Welfare), ICAR, New Delhi.

Prof. Dr. J.P. Thapliyal and Prof. Michel Fouaereau, Marseille University, France.

Prof. P.A. Cazenave and Mr. S. Avrameaj, University of Paris, Prof. Institute Pasteur, France.

Dr. P.K. Pandey, Director, IASRI, ICAR, New Delhi.

Dr. P. Natarajan, Director, CSMCRI, Bhavanagar.

Dr. Subba Rao, Director, CECRI, Karaikudi

Dr. H.S. Pabla, IFS, Jt. Director, Wild Life Institute of India, Dehra Dun.

Veraval

Dr. K. Gopakumar, Director, CIFT, Cochin.

Shri. K. Venkataeshwar, Scientist, CFETC (CIFE), Kakinada.

Shri. P.C. Malli, Fisheries Officer, Okha.

Bombay

Prof. D. Ramananda Rao, CIFE, Bombay.

Mr. Prado J., Scientist, FAO, Infofish, Kaula Lumpur, Malaysia.

Karwar

Dr. Manmohan, Dr. B.B. Chaugule and Shri. Vijendra Patil, Pune University, Pune.

Dr. A.B. Dandekar, Dept. of Zoology, Modern College, Pune.

Shri. K.K. Sethumadhavan, Head Dept. of Zoology, Govt. Victoria College, Palakkad.

Shri. M.F. Rahaman, Fisheries Development Officer, Karnataka Power Corporation.

Shri. S.M. Soratur, B.S.R. Arts and Science College, Harugeri.

Shri. S.G. Ballary and Prof. Srevatsa, L.V.D. College, Raichur, Karnataka.

Prof. H.D. Kanasa, Kisan Veer Mahavidyalaya, Wai, Satara Dt.

Dr. M. Gayasuddin, Poona College Camp, Pune.

Mangalore

Shri. A.M. Belliappa, Minister for Ports and Fisheries, Govt. of Karnataka.

Shri. K. Venkateswara, Shri M.K. Chouksey and trainees of D.FSc, CIFE, Bombay.

Vizhinjam

Shri. K.K. Thamli, College of Fisheries, Assam Agri. University.

Prof. (Sr.) Mercy, Holy Cross College, Nagercoil.

Prof. K. Vareethaiah, St. Jude's College, Thottoor.

Prof. Samuel Joseph, Christian College, Chengannur.

Prof. M. Narayan, Asian Instt. of Rural Development, Bangalore.

Shri. David Thomas Kurian, Agra University.

S/Shri. Joseph Manissery, M.H. Bhandarai and R.M. Prabhu, Fisheries College, Mangalore.

Tuticorin

Dr. V.L. Chopra, Director General, ICAR and Secretary Dept. of Agriculture Research and Education, Govt. of India, New Delhi.

Dr. V. Gnanaprakasam, Registrar, T.N. Veterinary and Animal Sciences University, Madras.

Dr. Ragavendra Rao, Dy. Director, Staff Training College, Dept. of Fisheries, Tamil Nadu.

Shri. K.S. Gururaj, Commanding Officer, INS Kardip, Andaman & Nicobar Islands.

Dr. A. Ramasamy, Asst. Director, MPEDA, Thanjavur.

Dr. Pramjit Singh Siddhu, IAS, Sub Collector, Thiruppur.

Dr. Amarjit Kaur, Asst. Mycologist, PAU, Ludhiana.

Dr. T.S.G. Iyer, Principal Scientist, CIFT, Cochin.

Shri. D. Jayakumar, Hon'ble Minister, Fisheries, Govt. of Tamil Nadu.

Dr. M. Mohamed Halibhakhan, Regisrtar, T.N., Veterinary & Animal Sciences University.

Dr. D. Paul Raj, Jt. Secretary, Fisheries, Govt. of Tamil Nadu.

Shri. K.V. Mathew, Fisheries Training Complex, Gujarat.

Shri. Hemanthkumar Sinha, IAS, District Collector, Chidambaranar Dt., Tuticorin.

Shri. Ansar Ali, District Collector, Chidambaranar Dt., Tuticorin.

Shri. M.R. Janardhanan, M.P., Nellai Parliamentary Constituency.

Shri. X. Rajamannar, MLA, Ottapidaram Constituency.

Dr. K. Gopakumar, Director, CIFT, Cochin.

Shri. M.K.R. Nair, Director, IFP, Cochin.

Shri. J.V. Dixitulu, Editor, Fishing Chimes, Visakhapatnam.

Madras

Dr. V.L. Chopra, Director General, ICAR and Secretary, Dept. of Agriculture Research and Education, Govt. of India, New Delhi.

Dr. K. Radhakrishna, Assistant Director General (MF) ICAR, New Delhi.

Dr. K.K. Tandon, Professor, Dept. of Zoology, Panjab University, Chandigarh.

Dr. A.K. Natarajan, Professor, University of Leiden, Netherlands.

Dr. F. Palitti, Professor, University of Viterlo, Italy.

Kakinada

Shri. A. Krishnam Raju, Srinagar, Kakinada.

Shri. Rajesh Mittal, Conservator of Fisheries and Wildlife Management, Rajamundri.

Shri. M.L. Rustagi,Sr. Scientist, CIFOM, Kathota tal (Lucknow).

Visakhapatnam

Dr. Y.N. Reddy, Professor, College of Agriculture, Hyderabad.

Mr. Per J. Sparre, Danish Institute for Fisheries and Marine Research, Denmark.

Shri. P.K. Rastogi, Commissioner of Technical Education, Hyderabad.

Dr. P.V. Dehadrai, Deputy Director General (Fy), ICAR, New Delhi.

Mr. Siebren C. Venema, Project Manager, FAO/DANIDA, Fish Stock Assessment Training Project, Dept. of Fisheries, FAO, Rome.

Dr. K. Radhakrishna, Assistant Director General (MF), ICAR, New Delhi.

Minicoy

Shri. Satish Chandra, IAS, Administrator, Union Territory of Lakshadweep.

Shri. Qamar Ahmed, IPS, Supdt. of Police, Union Territory of Lakshadweep.

Dr. A.K. Bandopadhya, Director, CARI, Port Blair, Andaman and Nicobar Islands.

ICAR INTER-INSTITUTIONAL SPORTS MEET

ICAR Inter-institutional sports meet for Zone IV was hosted by CMFRI at GCDA Stadium grounds at Cochin from 5-9 November '92.

Around 400 participants from 13 ICAR Institutes located at southern part of the country participated along with IVRI, Izatnagar. Other participating Institutes were, CPCRI-Kasaragod, NRC-Sorghum-Hyderabad, CTCRI-Trivandrum, CIFT-Cochin, CIBA-Madras, NRC-Cashew-Puthur, IIHR-Bangalore and CMFRI-Cochin.

PUBLICATIONS

ALAGARAJA, K., K. BALAN, K.S. SCARIAH, K. VIJAYALAKSHMI, JOSEPH ANDREWS AND C.J. PRASAD 1992. Present status of exploitation of fish and shellfish resources: Marine fish production of maritime States of the west coast of India. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 38-55.

AMEER HAMSA, K.M.S. AND H. MOHAMAD KASIM 1992. Growth and production potential of young grouper *Epinephelus tauvina* (Forskal) reared in fixed net cages. *J. mar. biol. Ass. India*, 34 (1&2) : 271-276.

ARUMUGAM, G., S. RAJAPACKIAM AND T.S. BALASUBRAMANIAN 1992. On the landing of Hump-back dolphin *Sousa chinensis* at Tuticorin. *Mar. Fish. Infor. Serv., T&E Ser.*, 115 : p.19

BALAKRISHNAN, S., M. RAVICHANDRAN AND N. KALIAPERUMAL 1992. Studies on the distribution and standing crop of algae at Muthupet estuary, Tamil Nadu. *Seaweed Res. Utlin.*, 15 (1&2) : 63-68.

BALASUBRAMANIAN, T.S., S. RAJAPACKIAM AND G. ARUMUGAM 1992. An account of the disposal of deep sea sharks and skates at Tuticorin. *Mar. Fish. Infor. Serv., T&E Ser.*, 116 : 10-12.

BENNET, P. SAM AND G. ARUMUGAM 1991. The present status of small-scale traditional fishery at Tuticorin. *Ibid.*, 113 : 1-16.

BENSAM, P. 1993. Sea fishes. *In*: Sea fishes. *Hand book on Aquafarming*. Marine Products Export Development Authority, Kochi. Part I, pp. 9-58.

BENSAM, P. 1993. Prospects of farming "Groupers" in India. Paper presented at the 'INDAQUA', 20-23 March '93 organised by the Marine Products Export Development Authority, Kochi, at Madras, March, 1993.

BENSAM, P. AND N.G. MENON 1992. The endangered, vulnerable and rare demersal finfishes of India. National Seminar on Endangered fishes of India, 25-26 April, 1992, Allahabad, *Abstract* : p48.

CHANDRIKA, V. AND P.V. RAMACHANDRAN NAIR 1992. Studies on bacterial flora of Trivandrum coastal water. *J. mar. biol. Ass. India*. 34 (1&2) : 47-53.

CHENNUBHOTLA, V.S.K., P. KALADHARAN, N. KALIAPERUMAL AND M.S. RAJAGOPALAN 1992. Seasonal variation in production of cultured seaweed *Gracilaria edulis* (Gmelin) Silva in Minicoy lagoon (Lakshadweep). *Seaweed Res. Utiln.*, 14(2) : 103-107.

CHENNUBHOTLA, V.S.K., V.A. KUNHIKOYA AND A. ANASUKOYA 1992. Record production of *gracilaria edulis* in culture system in Minicoy Lagoon. *Mar. Fish. Infor. Serv., T&E Ser.*, 118 : 12-13.

DEVADOSS, P. AND S. CHANDRASEKAR 1991. A note on the rare snaggle tooth shark, *Hemipristis elongatus*. *Ibid.*, 114, p.36.

DIWAN, A.D. AND V. BASKARAN 1992. Effect of salinity stress on neurosecretory cells, protein and free amino acid content and ammonia excretion rate of prawn *Penaeus indicus* H. Milne Edwards. *J. Aqua. Tropics*, 7 : 95-108.

DIWAN, A.D. AND A. NANDAKUMAR 1992. A stepping-stone in developing marine fish gene bank. *Mar. Fish. Infor. Serv., T&E Ser.*, 118:1-3.

EBENEZER, I.P. 1992. On the landing of a leather back turtle. *Ibid.*, 118, p.20.

GANAPATHY, A. 1992. On a porpoise *(Neophocaena phocaenoides)* stranded along Palk Bay coast, near Thondi, Tamil Nadu. *Ibid.*, 117 : p.17.

GANAPATHY, A. 1992. Unusually heavy landings of cow nose ray, *Rhinoptera javanica* along the Palk Bay coast, near Thondi. *Ibid;* 117: p.20.

GOPAKUMAR, G. AND K.T. THOMAS 1991. On the emerging fishery of mackerel scad, *Decapterus macarellus* from Vizhinjam. *Ibid.*, 113 : 16-17.

GOPINATHA MENON, N., V.N. BANDE, C. MUTHIAH, S.G. RAJE, P.U. ZACHARIA AND K. BALACHANDRAN 1992. Present status of exploitation of fish and shellfish resources : Catfishes. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 133-153.

GRACE MATHEW 1991. On the first record of the deep sea shark *Centrophorus granulosus* (Bloch and Schneider) from Indian Seas. *Mar. Fish. Infor. Serv., T&E Ser.*, 113 : 22-23.

GRACE MATHEW, M. FEROZ KHAN AND K. NANDAKUMARAN 1992. Present status of exploitation of fish and shell fish resources: Flatfishes and flatheads. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 197-204.

HAMEED BATCHA AND M. BADRUDEEN 1992. Length-weight relationship and relative condition of *Leiognathus brevirostris* (Valenciennes) from Palk Bay. *J. mar. biol. Ass. India*, 34 (1&2) : 269-270.

JAMES, D.B. 1993. Sea cucumber. Technical paper presented at the Business session of 'INDAQUA 93', Marine Products Export Development Authority, Kochi at Madras, 3pp.

JAMES D.B. 1993. Sea-urchin culture. *In:* Seaweed, Sea-urchin and Sea-cucumber. *Handbook on Aquafarming.* Marine Products Export Development Authority, Part II, pp. 23-30

JAMES, D.B. 1993. Sea-cucumber culture. *In:* Seaweed, Sea- urchin and Sea-cucumber. *Ibid.*, Part III pp. 33-47.

JAMES, P.S.B.R. 1992. A review of the existing regulations in the maritime States of India in relation to exploitation of fishery resources and their conservation and management. *J. mar. biol. Ass. India*, 34 (1&2) : 84-89.

JAMES, P.S.B.R. 1992. Present status of exploitation of fish and shellfish resources: Impact of fishing along the west coast of India during southwest monsoon period on the finfish and shellfish resources and the associated management considerations. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 251-259.

JAMES, P.S.B.R. 1993. Recent advances in marine fisheries research in India. Issued on the occasion of Silver Jubilee Celebrations of Staff Recreation Club, *Souvenir*, pp. 6-8.

JAMES, P.S.B.R., K.N. KURUP AND N.G.K. PILLAI 1991. A review of present status of marine fisheries of Kerala. *Mar. Fish. Infor. Serv., T&E Ser.*, 114 : 1-8.

JAMES, P.S.B.R. AND K.A. NARASIMHAM 1993. Molluscs. *In: Hand book on Aquafarming*. Marine Products Export Development Authority, Kochi - 87 pp.

JAMES, P.S.B.R., P.P. PILLAI, N.G.K. PILLAI, A.A. JAYAPRAKASH, G. GOPAKUMAR, MOHAMED KASIM, M. SIVADAS AND K.P. SAID KOYA 1992. Fishery, biology and stock assessment of small tunas. *Colloquium on Tuna Research, Cochin*, 11-12 Nov. 1992, FSI, G : 1-15.

JAMES, P.S.B.R., P.P. PILLAI, A.A. JAYAPRAKASH, N.G.K. PILLAI, G. GOPAKUMAR, T.M. YOHANNAN, C. MUTHIAH, G.M. KULKARNI AND S. KEMPARAJU 1992. Present status of exploitation of fish and shellfish resources: Tunas and Billfishes. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 56-84.

JANCY GUPTA AND KRISHNA SRINATH 1992. Firstline extension programme at Kandakka-

davu, Ernakulam. *Mar. fish. Infor. Serv., T&E Ser.*, 115 : 7-11.

JAYADEV S. HOTAGI 1992. On a marine turtle *Lepidochelys olivacea* landed at Basseein Kolliwada in Maharashtra. *Ibid.*, 118 : p. 19.

JAYASANKAR P. 1991. Sillaiginid fishes of Palk Bay and Gulf of Mannar with an account on the maturation and spawning of Indian sand whiting, *Sillago Sihama* (forsskal). *Indian J. Fish*, 38 (1): 13-25.

JAYASANKAR, P. 1992. Revival of Ribbonfish fishery in Mandapam region. *Mar. Fish. Infor. Serv., T & E Ser.*, 118 : 16-17.

JAYASANKAR, P. AND M. BOSS 1992. Observation on catfish landings by pair trawlers at Rameswaram. *Ibid.*, 118 : 17-18.

KAKATI, V.S. AND C.K. DINESH 1991. Bumper trawl net catches of 'Karikkadi' prawns *(Parapenaeopsis stylifera)* close to the coast of Karwar. *Ibid.*, 114 : 33-34.

KALIAPERUMAL, N. 1993. Seaweed culture. *In:* Seaweed, Sea-urchin and Sea-cucumber. *Hand book on Aquafarming*. Marine Products Export Development Authority, Kochi. pp. 9-22.

KALIAPERUMAL, N.1993. Seaweeds. Marine Products Export Development Authority, Kochi. pp. 1-11.

KALIAPERUMAL, N., S. KALIMUTHU AND J.R. RAMALINGAM, 1992. Studies on the agar content in *Gracilaria arcuata* and *G. corticata var. cylindrica*. *Seaweed Res. Utiln.* 15(1&2) : 191-195.

KALIAPERUMAL, N. AND S. KALIMUTHU 1993. Need for conservation of economically important seaweeds of Tamil Nadu coast and timetable for their commercial exploitation. *Mar. Fish. Infor. Serv., T&E Ser.*, 119 : 5-12.

KALIAPERUMAL, N., S. KALIMUTHU, K. MUNIYANDI, J.R. RAMALINGAM, V.S.K. CHENNUBHOTLA, K. RAMA RAO, P.V. SUBBA RAO, P.C. THOMAS, S.H. ZAIDI AND K. SUBBARAMAIAH 1992. Seaweed resources off Tamil Nadu coast. Sector III. Valinokkam – Keelakarai. *Seaweed Res. Utiln.*, 15 (1&2) : 11-14.

KALIMUTHU, S., N. KALIAPERUMAL AND J.R. RAMALINGAM 1992. Distribution and seasonal changes of marine algal flora from seven localities around Mandapam. *Ibid.*, 15 (1&2) : 119-126.

KASIM, H.M. 1993. Aquatic pollution and its stress on the physiological aspects of some culturable fishes. *In:* G. Santhanakumar and A.M. Selvaraj (Ed.), *Aquatic Pollution*. J.J. Publishers, Madurai, India pp. 27-43.

KASIM, H. MOHAMAD, K.M.S. AMEER HAMSA AND T.S. BALASUBRAMANIAN 1993. On an accidental landing of false killer whale *Pseudorca crassidens* by drift gillnet off Veerapandianpatnam, Gulf of Mannar. *Mar. Fish. Infor. Serv., T&E Ser.*, 120 : 18-19.

KASIM, H. MOHAMAD, T.S. BALASUBRAMANIAN, K.M.S. AMEER HAMSA AND S. RAJAPACKIAM 1991. Incidence of sharks wounded by plastic bands. *Ibid.*, 114 : 37-38.

KASIM, H. MOHAMAD, T.S. BALASUBRAMANIAN, S. RAJA PACKIAM AND V.S. RENGASAMY 1991. Fish mortality due to pollution by industrial effluents in inshore waters of Kayalpatnam. *Ibid.*, 113 : 26-28.

KEMPARAJU, S., UMA S. BHAT AND G. SUBRAMANYA BHAT 1992. Guidelines issued by Karnataka purse seine fishermen's Association (Mangalore Branch) to avoid conflicts among purse seine operators. *Ibid.*, 116:12-14.

KRIPA, V. AND MATHEW JOSEPH 1992. Fishery for marine clam, *Sunetta scripta* at Vypeen Island, Cochin. *Ibid*, 117:11-13.

KRIPA, V. AND MATHEW JOSEPH 1993. Clam fishery of north Vembanad Lake. *Ibid.*, 119 : 12-16.

KUBER VIDYASAGAR AND V.D. DESHMUKH 1992. Stock assessment of *Loligo duvaucelii* (D'Orbigny) in Bombay waters. *J. mar. biol. Ass. India*, 34 (1&2) : 14-17.

KULKARNI, G.M., S. KEMPARAJU, MADAN MOHAN, UMA S. BHAT AND C. PURANDHARA 1991. On an unusually heavy catch of Black pomfret, *Formio niger* by purse seine along Dakshina Kannada coast. *Mar. Fish. Infor. Serv., T&E Ser.*, 114 : 34-35.

KUMARAN, M., K.V. NARAYANA RAO, G.G. ANNIGERI, MADAN MOHAN, P.N. RADHAKRISHNAN NAIR, PUTHRAN PRATHIBHA, M. ABDUL NIZAR, V.K. JANAKI AND UMA S. BHAT 1992. Present status of exploitation of fish and shellfish resources : Oil sardine. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 92-110.

LAZARUS, S., K.S. SCARIAH, M.Z. KHAN AND P.K. VELAYUDHAN 1992. Present status of exploitation of fish and shellfish resources : Ribbonfishes. *Ibid.*, 45 : 121-132.

LUTHER, G., K.V. NARAYANA RAO, G. SYDA RAO, C. MUTHIAH, G. GOPAKUMAR, N.G.K. PILLAI AND PRATHIBHA PUTHRAN 1992. Present status of exploitation of fish and shellfish resources of India : Whitebaits. *Ibid.*, 45 : 111-120.

MAINKAR, K.R. 1992. On a whale shark landed at Makarabagh near Malvan, in Maharashtra. *Mar. Fish. Infor. Serv., T&E Ser.*, 118 : p 19.

MATHEW, K.J., V. MOHAN AND KANAKASABAPATHY 1992. Bioliography (Part-2). The publications by the staff of Central Marine Fisheries Research Institute 1986-90. *CMFRI spl. pub.*, No. 52. 126 pp.

MARICHAMY, R. 1993. The mud crab *Scylla serrata* - and investment opportunities for culture. Paper presented at the Business Session of 'INDAQUA '93 organised by the Marine Products Export Development Authority, Cochin at Madras. Special Issue, pp. 1-18.

MARICHAMY, R., A.A. JAYAPRAKASH, N. RAMAMOORTHY AND M. BOSE 1992. Seasonal landings of oil sardine *Sardinella longiceps* at Rameswaram, Pamban and Mandapam areas. *Mar. Fish. Infor. Serv., T&E Ser.*, 117 : 9-11.

MARICHAMY, R., A.P. LIPTON AND P. NAMMALWAR 1992. Planning and development of Marine Fisheries Research Centre. *Proc. Workshop on Management of Aquacultural Research Stations (Operations Management), NAARM*, Hyderabad. pp. 1-12.

MARICHAMY, R., A.P. LIPTON, A. GANAPATHY AND J.R. RAMALINGAM 1993. Large scale exploitation of sea horse *(Hippocampus kuda)* along the Palk Bay coast of Tamil Nadu. *Mar. Fish. Infor. Serv., T&E Ser.*, 119 : 17-20.

MARICHAMY, R. AND S. RAJAPACKIAM 1992. Experiments on larval rearing and seed production of mud crab *Scylla serrata*. *Proc. of Seminar on Mud Crab Culture*, Bay of Bengal Programme. Rep. 51 : 135-141.

MOHAMED SUNIL KUMAR, K.K. VIJAYAN AND A.D. DIWAN 1993. Histomorphology of the neurosecretory system in the Indian White prawn *Penaeus indicus* H. Milne Edwards. *Bull. Inst. Zool. Academic Sinica*, 32(1) : 39-53.

MOHAMED SULTAN, M., P.K. MAHADEVAN PILLAI AND P. THIRUMILU 1992. On the traditional small-scale fisheries at Pudumanikupam, Madras during 1979-88. *Mar. Fish. Infor. Serv., T&E Ser.*, 116 : 7-10.

MOHAN, R.S. LAL 1992. Some observations on the whales *Balaenoptera edeni, B. musculus* and *Megaptera novaeangliae* washed ashore along

the Indian coast with a note on their osteology. *J. mar. biol. Ass. India*, 34 (1&2) : 253-255.

MOHAPATRA, B.C. AND A. NOBLE 1992. Liver and kidney damage in Grey mullet *Liza parsia* (Hamilton and Buchanan) on exposure to an organo-phosphate 'Nuvan'. *Ibid.*, 34 (1&2) : 218-221.

MURTY, A.V.S. 1992. A critical study on the bad effects of upwelled waters on fisheries as exemplified by the situation of the Kerala-Karnataka region of the west coast of India. *Ibid.*, 34 (1&2): 246-252.

MUTHIAH, P., K.A. NARASIMHAM, C.P. GOPINATHAN, D. SUNDARARAJAN 1992. Larval rearing, spat production and juvenile growth of the blood clam *Anadara granosa*. *Ibid.*, 34 (1&2) : 138-143.

NAIR, K.PRABHAKARAN, M.M. MEIYAPPAN, P.S. KURIAKOSE, R. SARVESAN, A.P. LIPTON, SUNIL KUMAR MOHAMED, P.K. ASOKAN, MATHEW JOSEPH AND D. NAGARAJA 1992. Biology of squids. *Bull. fish. surv. India*, 23:27-42.

NAIR, K. PRABHAKARAN, M.M. MEIYAPPAN, G. SYDA RAO, K. SUNIL KUMAR MOHAMED, KUBER VIDYASAGAR, K.S. SUNDARAM AND A.P. LIPTON 1992. Present status of exploitation of fish and shellfish resources: Squid and cuttlefish. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 226-241.

NAIR, K.V. SOMASEKHARAN, K.G. GIRIJAVALLABHAN, N. GOPALAKRISHNA PILLAI, PUTHRAN PRATHIBHA, P.M. ABOOBAKER, M. ABDUL NIZAR AND J. NARAYANA SWAMY 1992. On the incursion of brown algae and Sargassum fishes into the Cochin backwaters. *Mar. Fish. Infor. Serv., T&E Ser.*, 116 : 15-17.

NAIR, K.V. SOMASEKHARAN, VINAY D. DESHMUKH AND S.G. RAJE 1992. Present status of exploitation of fish and shellfish resources: Lizard fishes. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 182-196.

NAMMALWAR, P. 1993. Milkfish and grey mullet culture in India. Presented in the Business Session of 'INDAQUA - 93' organised by the Marine Products Export Development Authority, Kochi at Madras, 20-23 March 1993 :pp. 1-9.

NAMMALWAR, P., S. KRISHNA PILLAI, M. BADRUDEEN, V. THANAPATHI, R. SOMU AND V. SIVASAMY 1992. On the stranding of sperm whales at Nagapattinam, Tamil Nadu coast. *Mar. Fish. Infor. Serv., T&E Ser.*, 115 : 16-17.

NAMMALWAR, P., P. LIVINGSTON, C. KASINATHAN, N. RAMAMURTHY AND P. POOVANNAN 1992. Instances of whale shark *Rhiniodon typus* Smith caught along the Tamil Nadu coast. *Ibid.*, 116 : p 20.

NAMMALWAR, P., R. MARICHAMY, A. RAJU, A.A. JAYAPRAKASH, C. KASINATHAN, N. RAMAMOORTHY AND V. SETHURAMAN 1992. On the stranding of Sei whale, *Balaenoptera borealis* Lesson at Mandapam along the Palk Bay coast. *Ibid.*, 117 : 18-19.

NARASIMHAM, K.A., R. MARICHAMY, D.B. JAMES, P. NAMMALWAR, A.C.C. VICTOR, N. KALIAPERUMAL, M.E. RAJAPANDIAN, S. DHARMARAJ, G. MAHESWARUDU, A.D. GANDHI, D. SUNDARARAJAN, M.R. ARPUTHARAJ, M. MUNIYANDI, S. KALIMUTHU, J.X. RODRIGO, M. SELVARAJ, A. DASMAN FERNANDO, SOOSAI V. RAYAN, N. JESURAJ, P. MUTHUKRISHNAN AND D. BOSCO FERNANDO 1992. The survey of Valinokkam Bay and adjoining area to assess its suitability for integrated sea farming – A Report. *Ibid.*, 117 : 1-8.

NOBLE, A., M.H. DHULKHED, T.M. YOHANNAN, G. GOPAKUMAR, N.G.K. PILLAI AND

G.M. KULKARNI 1992. Present status of exploitation of fish and shellfish resources: Indian Mackerel. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 85-91.

NOBLE, A. AND P. GEETHA 1992. The Indian Mackerel *Rastrelliger kanagurta* (cuvier), an annotated bibliography. *CMFRI spl. pub.*, No. 52. 126 pp.

NOBLE, A. AND A.K.V. NASSER 1992. On a Sei whale *Balaenoptera borealis* landed at Puthuvypu in Vypeen Island near Cochin. *Mar. Fish. Infor. Serv., T&E Ser.*, 116 : p 18.

PILLAI C.S. GOPINADHA, G. GOPAKUMAR AND MADAN MOHAN 1992. Ichthyofauna of the intertidal reef flats of Minicoy Atoll, Lakshadweep: An analysis of its structure, relative abundance and food. *J. mar. biol. Ass. India*, 34 (1&2) : 74-83.

PILLAI, P.K. MAHADEVAN 1992. The oil sardine fishery along northern Tamil Nadu coast with a note on unusually heavy landings at Cuddalore, Pazhayar and Kaveripattinam. *Mar. Fish. Infor. Serv., T&E Ser.*, 115 : 12-14.

PILLAI N. NEELAKANTA, C. SUSEELAN, K.N. RAJAN, P.E. SAMPSON MANICKAM, K.R. MANMADAN NAIR AND K.N. SALEELA 1992. Shrimps. *In:* Shrimps, Lobsters, Mud crabs. *Hand book on Aquafarming*. Marine Products Export Development Authority, Cochin. pp 9-43.

PILLAI N. NEELAKANTA, C. SUSEELAN, K.N. RAJAN, P.E. SAMPSON MANICKAM, M.R. MANMADAN NAIR AND K.N. SALEELA 1993. Hatchery production of shrimp seeds. Presented in the Business Session of 'INDAQUA', 20-23 March '93 organised by the Marine Products Export Development Authority, Kochi at Madras : pp. 1-19.

PILLAI, P.P., K.P. SAID KOYA, N.G.K. PILLAI AND A.A. JAYAPRAKASH 1992. Fishery and biology of yellowfin tuna occurring in coastal fishery in Indian seas. *Colloquium on Tuna Research, Cochin*, 11-12 Nov. 1992, FSI, B:1-11.

PURANDHARA, C. AND C.H. VAMAN NAIK 1992. On the stranding of *Balaenoptera physalus* at Kota, Dakshina Kannada. *Mar. Fish. Infor. Serv., T&E Ser.*, 115 : p 18.

RADHAKRISHNAN NAIR, P.N. 1993. The status of carangid fishery at Vizhinjam, Trivandrum coast during 1979-88. *Ibid.*, 120 : 1-12.

RAJAGOPALAN, M.S., P.S.B.R. JAMES AND N.G.K. PILLAI 1992. Effect of environmental fluctuations on coastal tuna fisheries. *Colloquium on Tuna Research*, Cochin, 11-12 Nov. 1992, FSI.

RAJAGOPALAN, M.S., P.A. THOMAS, K.J. MATHEW, G.S. DANIEL SELVARAJ, RANI MARY GEORGE, C.V. MATHEW, T.S. NAOMI, P. KALADHARAN, V.K. BALACHANDRAN AND GEETHA ANTONY 1992. Present status of exploitation of fish and shellfish resources: Productivity of the Arabian Sea along the southwest coast of India. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 9-37.

RAJAMANI, M. AND M. MANICKARAJA 1991. On the collection of spiny lobsters by skin-divers in the Gulf of Mannar off Tuticorin. *Mar. Fish. Infor. Serv., T&E Ser.*, 113 : 17-18.

RAJAMANI, M. AND M. MANICKARAJA 1991. A note on the commercial fishery of the king prawn off Tuticorin. *Ibid.*, 113 : 24-25.

RAJE, S.G. 1991. Disposal of catch from *Dol* net at Versova, Bombay. *Ibid.*, 113 : 18-20.

RAJE, S.G. 1991. Unusual catch of catfish *Tachysurus dussumieri* in bottom set gillnet at Versova. *Ibid.*, 113 : 23-24.

RAJE, S.G. AND V.V. SINGH 1992. Utilisation of fishery by-products by traditional fishermen of Maharashtra. *Fishing Chimes*, 12(2) : 47-49.

RANI PALANISWAMY AND S.M. SATHAKKATHULLAH 1992. Holding and spawning of the edible oyster *Crassostrea madrasensis* during off season. *Mar. Fish. Infor. Serv., T&E Ser.*, 118 : p. 13.

RAO, D.S., C.P. RAMAMIRTHAM, A.V.S. MURTY, S. MUTHUSAMY, N.P. KUNHIKRISHNAN AND L.R. KHAMBADKAR 1992. Present status of exploitation of fish and shell fish resources : Oceanography of the Arabian Sea with particular reference to the southwest monsoon. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 4-8.

RAO, T. APPA, K.V. SOMASEKHARAN NAIR, S.K. CHAKRABORTY AND S.G. RAJE 1992. Present status of exploitation of fish and shellfish resources : Croakers. *Bull. Cent. Mar. Fish. Res. Inst.*, 45 : 169-181.

RAO, K. SATYANARAYANA AND P.K. MAHADEVAN PILLAI 1992. Commercial trawl fishery off Madras coast during 1980-89 with a comparative account of the catch trend of shrimp and fish trawlers during 1989-91. *Mar. Fish. Infor. Serv., T&E Ser.*, 115 : 1-6.

RAO, C.V. SESHAGIRI 1991. On the landing of a rare salt water crocodyle *Crocodylus porosus at Dibbapalem*, south of Visakhapatnam. *Ibid.*, 113 : 28-29.

RAO, C.V. SESHAGIRI 1992. On the occurrence of whale shark *Rhiniodon typus* along the Kakinada coast. *Ibid.*, 116: p. 19.

RAO, C.V. SESHAGIRI AND K. NARAYANA RAO 1992. On the landing of a young spinner dolphin at Visakhapatnam, along Andhra coast. *Ibid.*, 115:p. 18.

RAO, C.V. SESHAGIRI AND K. NARAYANA RAO 1993. On the landing of a whale shark *Rhiniodon typus* Smith at Dibbapalam south of Visakhapatnam. *Ibid.*, 120: p. 17.

RAO, C.V. SESHAGIRI AND K. NARAYANA RAO 1993. On the landing of a large sized bottle-nose dolphin *Tursiops aduncus* at Visakhapatnam, along Andhra coast. *Mar. Fish. Infor. Serv., T & E Ser.*, 120: p. 18.

RAO, C.V. SESHAGIRI AND J.B. VARMA 1992. On the largest greasy Grouper *Epinephelus tauvina* Forsskal landed at Visakhapatnam. *Ibid.*, 117: p. 18.

REETA JAYASANKAR 1992. On the successful culture of *Gracilaria edulis* from spores. *Ibid.*, 117: 15-17.

SAID KOYA, K.P. AND E. VIVEKANANDAN 1992. Gillnet fishery off Veraval during 1982-90. *Ibid.*, 116: 1-6.

SAJI CHACKO AND M.M. THOMAS 1991. Invasion of clams in prawn culture fields: effects on the growth of prawns. *Ibid.*, 114: 31-33.

SATHIADAS,R., K.K.P. PANIKKAR AND A. KANAKKAN 1992. Costs and earnings of trawl operations along Nagapatinam coast of Tamil Nadu. *Ibid.*, 118: 4-11.

SATHIADAS, R. AND K.K.P. PANIKKAR 1992. Share of fishermen and middlemen in consumer price - A study at Madras region. *J. mar. biol. Ass. India*, 34 (1 & 2) : 18-25.

SEHARA, D.B.S. AND A.KANAKKAN 1992. Profitability level of trawlers operating from Cochin Fisheries Harbour. *Seafood Export Journal*, XXIV (3), May 1992. pp 14-21.

SEHARA, D.B.S., J.P. KARBHARI AND K.P. SALINI 1991.Economic feasibility of trawling in Maharashtra. *Mar. Fish. Infor. Serv., T & E Ser., 114:8-16.*

SEHARA, D.B.S., A.Y. *MESTRY AND* K.P. *SALINI 1992. A research note on economic performance of dol at Sasoon Dock. Ibid., 118:14-15.*

SEHARA. D.B.S., K. K. P. *PANIKKAR AND* J.P. *KARBHARI 1992. Present status of exploitation of fish and shellfish resources: Socio-economic aspects of the monsoon fisheries of*

the west coast of India. Bull. Cent. Mar. Fish. Res. Inst., 45: 242-250.

SIVADAS, M. *1991. An account of the hand lining fishery for snappers and groupers at Beypore, Calicut with a note on the biology of Pristipomoides typus. Mar. Fish. Infor. Serv., T & E Ser; 113: 20-22.*

SREENIVASAN, P.V. AND R. NATARAJAN *1992. Age and growth of the potamid snail Cerithidea (Cerithideopsilla) cingulata (Gmelin) in Vellar Estuary, southeast coast of India. J. mar. biol. Ass. India. 34 (1 & 2): 153-170.*

SRINIVASAN, M. AND K.J. MATHEW *1992. Distribution of Chaetognatha off Queen Maud Land, Antartica. Ibid., 34 (1 & 2): 287-290.*

SRIRAMACHANDRA MURTY, V., K.V. SOMASEKHARAN NAIR, P.A. THOMAS, S. LAZARUS, S.K. CHAKRABORTY, S.G. RAJE, C. GOPAL, P.U. ZACHARIA AND A.K. VELAYUDHAN *1992. Present status of exploitation of fish and shellfish resources: Threadfin breams. Bull. Cent. Mar. Fish. Res. Inst., 45: 154-168.*

SUBRAMANYA BHAT, G. *1992. Marine Fisheries of Karnataka– An Introduction. Mangal Lahar Souvenir 1992. New Mangalore Port Trust and Mangalore Town Official Language Implementation Committee.*

SUSEELAN, C., G. NANDAKUMAR, K.K. SUKUMARAN, V.D. DESHMUKH, K.N. RAJAN, M.ARAVINDAKSHAN AND P.T. SARADA *1992. Present status of exploitation of fish and shellfish resources : Prawns. Bull. Cent. Mar. Fish. Res. Inst., 45: 205-225.*

SUSEELAN, C AND K. PRABHAKARAN NAIR *1992. Endangered, vulnerable and rare estuarine shellfishes of India. National Seminar on endangered fishes of India, 25-26 April 1992, Allehabad. Abstracts pp. 38-39.*

SUSEELAN, C. AND K.N. RAJAN *1993. Marine prawn production in the low energy sector of Indian coast. In: Low energy fishing. Central Institute of Fishery Technology, Cochin. Special publication p. 19-29.*

SUSEELAN, C., N. NEELAKANTA PILLAI, E.V. RADHAKRISHNAN, K.N. RAJAN, K.R. MANMADAN NAIR, P.E. SAMPSON MANICKAM AND K.N. SALEELA *1993. Lobsters. In: Shrimps, Lobsters, Mudcrabs. Handbook on Aquafarming. Marine Products Export Development Authority, Kochi, pp. 47-54.*

THIRUMILU, P., P.K. MAHADEVAN PILLAI, K.S.. KRISHNAN AND P.POOVANNAN *1991. The fishing gears used in the exploitation of marine and brackish water fishery resources along Tamil Nadu coast. Mar. Fish. Infor. Serv., T&E Ser., 114:16-28.*

THIRUMILU, P. AND P. POOVANNAN *1993. Price structure of marine fishes landed at the Madras Fisheries Harbour with special reference to shellfishes. Ibid., 120: 12-17.*

THOMAS, P.A. *1991. Marine Porifera, In: Animal Resources of India, Protozoa to Mammalia - State of the Art Report: Zoological Survey of India, Calcutta, pp. 19-29.*

THOMAS, P.A. *1992. Marine products chemistry and sponges. Training Workshop on the use of chemical techniques for the study of Marine Products. Central Drug Research Institute, pp. 26-36*

THOMAS, P.A. *1993. An appraisal of the biological and biochemical diversity in sponges. National Symposium on Marine Natural Products.School of Chemistry, Andhra University, Visakhapatnam, 26-28 March, 1993. Abstracts pp. 18-19.*

VASUDEVAPPA, C. AND P.S.B.R. JAMES *1992. Food and feeding of the marine catfish Tachysurus dussumieri (Valenciennes) along the Dakshina Kannada coast, Karnataka. J. mar. biol. Ass. India, 34 (1&2): 144-152.*

VELAYUDHAN, T.S., A.C.C.VICTOR, S. DHARMARAJ AND A. CHELLAM *1993. Pearl production in relation to the graft tissue in the pearl oyster Pinctada fucata (Gould). Mar. Fish. Infor. Serv., T&E Ser., 119: 3-4*

VIJAYAKUMARAN. K. AND S. CHANDRASEKHAR *1992. On the occurrence of 'Wahoo', Acanthocybium solandri in the hooks and line catches of Lawsons Bay, Visakhapatnam. Ibid., 115: 15-16.*

VIVEKANANDAN, E. *1992. Catch trend and maximum sustainable yield of demersal fishes of Madras. J. mar. biol. Ass. India, 34 (1&2): 10-13.*

YOHANNAN, T.M., P.P. PILLAI AND K.P. SAID KOYA *1992. Fishery, biology and stock assessment of skipjack tuna in Indian seas. Colloquium on Tuna Research, Cochin, 11-12 Nov. 1992, FSI, F: 1-15.*

YOHANNAN, T.M.,AND M. SIVADAS *1993. Impact of ring net on the mackerel fishery at Calicut. Mar. Fish. Infor. Serv., T&E Ser., 119: 1-3*

ZACHARIA, P.U., K. SUNIL KUMAR MOHAMED, P.P. PILLAI AND C. PURANDHARA *1991. Bull's eye-An emerging trawl fishery resource along Dakshina Kannada coast. Ibid., 114 : 29-31.*

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Shri. A. Raju	S (SG)	DF/CUL/3
Dr. E.V. Radhakrishnan	Sr.S	CF/CUL/1.7, CF/CUL/1.8, CMFRI/IDP/2
Shri. S. Krishna Pillai	S(S-2)	FEM/ES/1
Dr. G. Maheshwarudu	S	CF/RE/1.12, CF/RE/1.14, CF/CUL/1.7 CF/CUL/1.8
Dr. P. Jayasankar	S	DF/RE/3, DF/RE/5,DF/RE/7
Ms. Reeta Jayasankar	S	FEM/SW/1

VERAVAL

Dr. Alexander Kurian	Sr.S	PF/RE/3, PF/RE/4
Shri. K.P. Said Koya	S	PF/RE/2.1, PF/RE/2.2
Shri. K.K. Philipose	S	CF/RE/1.11, CF/RE/1.13, CF/RE/1.14

BOMBAY

Dr. Kuber Vidyasagar	Sr.S	MF/RE/1.1
Dr. S.K. Chakraborty	Sr.S	DF/RE/4
Shri. M. Zaffar Khan	S(SG)	PF/RE/1.2,PF/RE/3, PF/RE/4
Shri. K.S. Sundaram	S(SG)	MF/RE/1, MF/RE/2
Dr. V.D. Deshmukh	Sr.S	CF/RE/1.11, CF/RE/1.13, CF/RE/1.14
Shri. S.G. Raje	S(SG)	DF/RE/4, DF/RE/5
Shri. M. Aravindakshan	S	CF/RE/1.11, CF/RE/1.13
Dr. V.V. Singh	S	FEM/ES/1

KARWAR

Shri. G.G. Annigeri	PS	PF/RE/1.1, PF/RE/2.3
Dr. V.S. Kakati	Sr.S	CF/RE/1.11, CF/RE/1.14, FORV/SS/3
Shri. V. Gandhi	S(SG)	DF/RE/3, DF/RE/5, DF/RE/7
Dr. P.K. Krishna Kumar	S	FEM/ES/1, FEM/MP/1

Dr. P.K. Asokan	S	MF/RE/1, MF/RE/2, MF/CUL/8

MANGALORE

Dr. P.V. Rao	PS	FORV/SS/3
Shri. K.K. Sukumaran	S(SG)	On study leave
Shri. C. Muthiah	S(SG)	PF/RE/2.1, PF/RE/4
Shri. G.M. Kulkarni	S	PF/RE/1.1, PF/RE/1.2
Shri. P.U. Zachariah	S	DF/RE/3, DF/RE/4, DF/RE/7
Dr. Sunil Kumar Mohamed	S	MF/RE/1, MF/RE/2
Ms. Prathibha Rohit	S	PF/RE/1.1, PF/RE/1.2

CALICUT

Dr. V. Narayana Pillai	PS	FEM/ES/1, FEM/RS/1.1, FORV/SS/1
Shri. M. Kumaran	PS	PF/RE/1.1, PF/RE/4
Dr. R.S. Lal Mohan	PS	DF/RE/5, DF/RE/6
Dr. P.S. Kuriakose	S(S-3)	MF/RE/2, MF/CUL/4
Shri. G.P. Kumaraswamy Achary	S(SG)	MF/RE/1, MF/RE/2, MF/CUL/4
Shri. K.K. Appukuttan	S(SG)	MF/RE/2, MF/CUL/4
Shri. T.M. Yohannan	S(SG)	PF/RE/2.1, PF/RE/2.2, PF/RE/2.3
Shri. C.V. Mathew	S	FEM/ES/1, FEM/ES/5
Shri. M. Feroz Khan	S	DF/RE/1, DF/RE/3, DF/RE/7

VIZHINJAM

Dr. P.A. Thomas	Sr.S	FEM/ES/1, FEM/AR/1
Dr. S. Lazarus	Sr.S	DF/RE/2, DF/RE/7, PF/RE/4
Ms. Rani Mary George	S(SG)	On study leave
Shri. G. Gopakumar	S(SG)	PF/RE/1.2, PF/RE/2.2
Dr. N. Ramachandran	S(S-2)	MF/RE/1, MF/RE/2
Dr. P. Kaladharan	S	FEM/ES/1
Ms.S. Jasmin	S	FEM/ES/1

TUTICORIN

Dr. M. Peer Mohamed	PS	PNP/44, FEM/MP/1
Dr. A.C.C. Victor	Sr.S	MF/CUL/4, MF/CUL/10, CMFRI/IDP/2
Shri. A. Chellam	S(SG)	On study leave
Shri. S. Dharmaraj	S(SG)	MF/CUL/4, MF/CUL/10
Shri. M.E. Rajapandian	S(SG)	MF/CUL/4, MF/CUL/9, CMFRI/IDP/2
Shri. P. Muthiah	S(SG)	On study leave
Shri. K. Ramadoss	S(SG)	MF/RE/2, MF/CUL/4, MF/CUL/9

Shri. P. Sam Bennet	S(SG)	PF/RE/1.1, PF/RE/4
Shri. K.M.S. Ameer Hamsa	S(SG)	DF/RE/1, DF/RE/2, DF/RE/7
Dr. H. Mohamad Kasim	Sr.S	PF/RE/2.1, PF/RE/2.2
Dr. D.B. James	Sr.S	FEM/CUL/2, CMFRI/IDP/2
Dr. M. Rajamani	Sr.S	CF/RE/1.12, CF/RE/1.14, CF/CUL/1.7
Dr. D.C.V. Easterson	Sr.S	PNP/44
Shri. D. Kandasamy	S(SG)	PNP/35, PNP/44, FEM/MP/1
Shri. D. Sivalingam	S(S-2)	MF/RE/1, MF/CUL/4
Shri. V.S. Rengasamy	S(S-2)	DF/RE/4, DF/RE/5, DF/RE/6, CMFRI/IDP/2
Ms. Rani Palanisamy	S	MF/CUL/4, MF/CUL/9

MADRAS

Dr. K. Satyanarayana Rao	PS	MF/CUL/8
Shri. N.S. Radhakrishnan	S(SG)	PF/RE/1.1, PF/RE/1.2
Shri. R. Thiagarajan	S(SG)	On study leave
Shri. R. Sarvesan	S(SG)	On study leave
Dr. P. Devadoss	Sr.S	DF/RE/1, DF/RE/5
Shri. J.C. Gnanamuthu	S(SG)	DF/RE/4, DF/RE/7
Shri. G. Mohanraj	S(SG)	DF/RE/1, DF/RE/3, DF/RE/6, DF/RE/7
Dr. P.V. Sreenivasan	Sr.S	MF/RE/2, MF/CUL/8
Dr. E. Vivekanandan	Sr.S	DF/RE/3, DF/RE/4
Dr. E. Paul Raj	Sr.S	PNP/35
Dr. M. Vijayakumaran	Sr.S	PNP/35
Dr. M. Rajagopalan	Sr.S	MF/CUL/8, FEM/ES/1, FEM/ES/5
Shri. M.M. Meiyappan	S(SG)	MF/RE/1, FORV/SS/3
Shri. V. Thangaraj Subramaniam	S(S-2)	CF/RE/1.12, CF/RE/1.14
Shri. P. Natarajan	S(S-2)	MF/RE/2, MF/CUL/8

KAKINADA

Dr. V. Sriramachandra Murty	Sr.S	DF/RE/4, DF/RE/5
Dr. G. Syda Rao	Sr.S	MF/RE/1, MF/RE/2, MF/CUL/8
Dr. P.N. Radhakrishnan Nair	Sr.S	PF/RE/2.3, PF/RE/4

VISAKHAPATNAM

Dr. G. Luther	PS	PF/RE/2.3, CMFRI/IDP/1
Dr. T. Appa Rao	PS	DF/RE/5
Shri. S. Reuben	S(S-3)	PF/RE/1.1, PF/RE/4
Dr. G. Sudhakara Rao	Sr.S	CF/RE/1.12
Shri. Y. Appanna Sastry	S(SG)	DF/RE/3, DF/RE/6

Shri. G. Radhakrishnan	S	MF/RE/1, MF/RE/2
Shri. K. Vijayakumar	S	FEM/ES/1, FEM/RS/1.1

MINICOY

Dr. V.S.K. Chennubhotla	PS	FEM/SW/1
Shri. M. Sivadas	S	PF/RE/2.2
Ms. P.T. Sarada	S	CF/CUL/1.7
Shri. Pon Siraimeetan	S(SG)	On study leave

KVK/TTC, NARAKKAL

Dr. M.M. Thomas	PS	Extension & Training, FF & E/26.1
Dr. D. Noble	Sr.S	Extension & Training
Ms. S. Kalavathi	S	Extension & Training

Centre-wise list of Technical/Administrative/Auxiliary/ Supporting staff

(Not a gradation list)

CMFRI-Headquarters, Cochin

Technical Staff

Technical Officers

Shri. S. Natarajan (T-8)

T-7

Shri. G. Balakrishnan
" P.R. Leopold - *Skipper*
" P.K. Velayudhan - *Mate*
" Varughese Philipose

T-6

Shri. V. Rajendran

T-5

Shri. K.C. Yohannan
" M. Ayyappan Pillai
" V.K. Balachandran
" K.N. Gopalakrishnan
" P. Karunakaran Nair
" Varghese Jacob
" G. Krishnankutty Nair
" P. Sivaraman
Ms. K.S. Leela Bhai
" V. P. Annam
Shri. P.M. Aboobaker
" R. Reghu
Ms. C. Nalini
Shri. V. Suresh
" A.A. Thankappan
Ms. Geetha Antony
Shri. P. Raghavan - *Photography*
" B. Ramesh - *Bosun*
" Nirmal Mathew - *Bosun*

T-4

Senior Technical Assistants

Shri. N.P. Kunhikrishnan
" K. Thulasidas
" Joseph Andrews
" K.L.K. Kesavan - *Sr. Artist*

T-II-3

Technical Assistants

Ms. A. Kanagam
Shri. A. Kanakkan
" S. Haja Najeemuddin
" C.J. Prasad
" A. Nandakumar
Ms. P.L. Ammini
Shri. K. Balachandran
" V.A. Narayanan Kutty
" Mathew Joseph
Ms. K. Ramani
Shri. D. Pugazhendi
" V. Radhakrishnan Nair
" N.B. Gopalakrishna Menon-*Bosun*
Ms. S. Girija Kumari - *Sr. Library Asst.*

T-I-3

Shri. K. Ramadoss Gandhi
" K. Chellappan
Ms. K.K. Valsala
Shri. M.N. Kesavan Elayathu
" L.R. Khambadkar
" J. Narayanaswamy
" M.P. Sivadasan
" M.Abdul Nizar

Ms. P. Geetha - *Lib. Asst.*
Shri. C.K. Dandapani - *Serang*
" T.R. Sreekumaran - *Oilman*
" C.D. Davis - *Motor Driver*
" S. Yadavaiah - *Motor Driver*
" K.J. Mathew - *Motor Driver*
" M.N. Appukuttan Nair - *Motor Driver*
" K. Chacko - *Projector Operator*
" M.A. Vincent - *Driver (Boat)*
" M.K. Gopalakrishnan - *Sr. Deckhand*
" K.S.Leon - *Sr. Deckhand*

Punch Card Operators

Shri. K.P. George
" M.B. Seynudeen
" P.P. Pavithran
Ms. M.R. Beena
" P.T. Mani
Shri. M. Ramachandran (T-2)
" K. Anandan (T-2)
Ms. Latha Khambadkar (T-2)
Shri. G. Subbaraman (T-2)

T-2

Junior Library Assistants

Ms. P. Suvarna
Shri. V. Mohan
" K.K. Sankaran - *Artist*
" K.K. Soman - *Motor Driver*

Senior Deckhands

Shri. P. Bhaskaran
" K.P. Vijayan
" K.C. Devassy
" P.D. Chidambaram– *Oilman-cum-Deckhand*
" K. Raju - Cook
" K.K. Bose - *Driver (Boat)*

T-1

Field Assistants

Shri. R. Anil Kumar
Shri. P.K. Baby
Ms. K.P. Salini
Shri. K.M. Venugopalan
" K. Solomon
" K.N. Pushkaran
" V.R. Arunachalam
" Thomas Kuruvilla
" K.C. Pradeep Kumar
Ms. P.K. Seetha
Shri. V.K. Suresh
" A. Udayakumar
Ms. T.N. Anandalakshmy
Shri. G. Sampath Kumar
Ms. P.M. Geetha - *Museum Assistant*

Administrative Staff

Shri. P. Bapaiah - *Sr. Adm. Officer*
" T.V. Asari - *Sr. Finance & Accounts Officer*
" K.U.K. Menon - *Asst. Finance & Accounts Officer*
" C. Muralidharan - *Adm. Officer*
" P. Aithappa Naik - *Asst. Adm. Officer*
" S. Subramanian - *Asst. Adm. Officer*
Ms. P.J. Sheela - *Asst. Director (Official language)*

Superintendents

Shri. R. Kuppuswamy
" V. Chemmutty
" J.M. Vaz
" P.J.Davis
" P. Ganesan
Ms. T.K. Ponnamma
" M.A. Seetha – *Sr. Stenographer*

Assistants

Shri. K. Nagarajan
" M.J. John
" A. Narayanaswamy
" S. Abdulla

Shri. K.L.K. Padmanabhan
" M. Ganapathy
Ms. P.V. Mary
Shri. K. Arumugham
" M. Velu
" N. Govindan
" T.N. Padmanabha Kurup
" V.V. Lakshminarayanan
" V. Mohanan

Stenographers

Shri. K.M. Surendran
" C. Yohannan
Ms. A.K. Omana
" D. Geetha

Junior Stenographers

Ms. N. Ambika
" N.R. Latha Devi
" K.V. Sajitha
" K.J. Malathi Devi
" N. Yesoda
Shri. C. G. Thomas
" C.N. Chandrasekharan
" R Chandrakesa Shenoy
" K.N. Murali
Ms. P.K. Anitha

Senior Clerks

Ms. T. Madhavi
Shri. V.P. Unnikrishnan
Ms. P.K. Sridevi
Shri. V. Chandrasekharan
Ms. A. Ranjini
" K.M. Annamma
" M.O. Leela
" K. Vijayalakshmi
" K.C. Karthiayini
Shri. A.P. Balakrishnan
" M.K. Abdulla
" Thomas Joy
Ms. M. Suseela
" K.C. Girija
" Alice Valuran
" V.K. Sobha
" M.M. Teresakutty
" Christina Joseph
" K. Santha
" A.K. Kunjipennu

Junior Clerks

Ms. N.K. Suseela
" G. Ambika
Shri. K.J. Mathew
" P.M. Bhaskaran
Ms. N.S. Sarala
" P.S. Sumathy
" M.G. Chandramathy
Shri. C.K. Sivadas
" K. Baburajan
" V.C. Antony
Ms. I.M. Baby Rajalakshmi
" V. Parukutty
Shri. M. Balaraman
" K.Ramadasan
Ms. K. Kousallia
Shri. Benny Mathew
" V.C. Subash
Ms. V. Jayalakshmi
Shri K. Sadanandan
" Augustus Julin Raj
" P.V. Devassy
Ms. N.G. Supriya
" P.K. Mary
" G. Ponnamma
" N.M. Ponnamma
" Madhavikutty
" Gowri Hareendran
Shri. K.M. Joseph
Ms. Benny Cherian
Shri. M.J. Tomy Prince - *Telephone*
Ms. K. Balamani – *Hindi Typist*

Auxiliary Staff

Ms. E.K. Uma - *Sr. Hindi Translator*
" E. Sasikala - *Hindi Translator*
Shri. V.A. Surendran - *Driver*
" A. Rajan - *Driver*
" M.R. Bharathan - *Deckhand*
" M. Krishnan - *Binder*
" N. Ravindranathan Nair - *Sr. Gestetner Operator*

Supporting Staff

SSG –IV

Shri. P.A. Vasudevan *Lab. Attendant*
" K.P. Joseph *Lab. Attendant*
" P.A. Vasu - *Fieldman*
" M.K. Peethambaran -*Fieldman*
" T.A. John - *Khalasi*
Ms. N. Leela - *Daftry*

SSG–III

Shri. K.S. Vaidyalingam – *Fieldman*
" M.L. Antony - *Lab. Attendant*
" A.P. Sebastian - *Peon*

SSG –II

Shri. T.A. Vijayan - *Peon*
" N.T. Velappan - *Peon*

Watchmen

Shri. B. Zainudheen
" E.F. Francis
" K. Ganesan
" C. Chandran
" G. Mithralal
" G. Vijayan
" P.K. Achuthan
" K.T. Rajappan

Messengers

Ms. R. Devalakshmi
Shri. T. Sreedharan
" A. Gopinathan
" K.C. Hezhakiel
" T. Vijayakumar
" T.M. Abdul Azeez
" M.P. Mohandas

Safaiwalas

Shri. K. Velayudhan
Ms. K.K. Kalliani
Shri. C.O. Viswambaran
Ms. B. Savithri
Shri. N.P. Mohanan
" V.C. Gopi

SSG-I

Watchmen

Shri. K. Velayudham
" E.J. James
" V.T. Ravi
" P.K. Ravindran
" P.K. Chellappan
" K.C. Rajappan

Messengers

Shri. D. Prakasan
" R. Ravindranathan Nair
" V.A. Kuttappan
" T.I. Soman
" N.K. Harshan
Ms. R. M. Sarasamma
" Pennamma Joseph
Shri. V. Krishnan
" P.V. Gopalan
" S. Mohanan - *Lift Operator*
" T.K. Antony - *Lift Operator*
" K.G. Radhakrishnan Nair - *Helper*
" V.H. Venu - *Binder*
" N.V. Thambi - *Lab. Attendant*
" S. Narayanan Achari - *Lab. Attendant*
Ms. J. Sudha Devi - *Cane Weaver*

Fieldmen

Shri. P.B. Jeevaraj
" P.S. Allocious
" P.V. Joy
" V.K. Aravindakshan
" M.K. Anil Kumar

Safaiwalas

Shri. P.D. Karunakaran
" B. Babu
Ms. A. Letha
Shri. N.K. Shanmughan

Gardeners

Shri. T. Lawrence
" K.C. Jayaprasad

Chavakkad Field Centre

Shri. K.G. Baby - *Field Asst.*

Quilon Field Centre

Shri. Babu Philip - *Tech. Officer*
" S.B. Chandrangathan - *Tech. Officer*
" C. Unnikrishnan - *Field Asst.*

Alleppey Field Centre

Shri. A.Y. Jacob - *Field Asst.*

Mandapam Regional Centre

Technical Staff

T-7

Shri. B.S. Ramachandrudu - Farm Engineer

T-5

Technical Officers

Shri. S. Kalimuthu
" M. Badrudeen
" C. Kasinathan - *Curator*
" P. Thankappan - *Foreman*

T-4

Shri. A.Ganapathy

T-II-3

Technical Assistants

Dr. K. Muniyandi
Shri. S. Palanichamy
" K. Muthiah
" V. Edwin Joseph - *Lib. Asst.*
" T.K. Sudhakaran - *Bosun*

T-I-3

Technical Assistants

Shri. J.R. Ramalingam
" M. Najmuddin
" M.R. Arputharaj
" M. Bose
" A.Ramakrishnan
" R. Subramanian
" Md. Jaffar - *Driver (Boat)*
" A. Muniyandi - *Artist*
" P. Muniasamy - *Deckhand*
" O. Muthukaruppan - *Motor Driver*
" R. Marimuthu - *Painter-cum-Polisher*
" T.P.Haridasan -*Carpenter*
" S. Mohideen Meerasa - *Sr. Deckhand*
" M. Ibrahim - *Deckhand*

T-2

Shri. M. Rengan - *Cook (Boat)*

T-I

Shri. N. Ramamurthy - *Museum Asst.*
" R. Sekhar - *Deckhand*
" A. Gandhi - *Field Asst.*
" V. Sethuraman - *Field Asst.*
" A. Shanmugavelu - *Tech. Asst.*
" Sanjay Kumar Dana - Mechanic
" A. Srinivasan - *Driver*

Administrative Staff

Shri. A. Sethubhaskaran-
Asst. Admr. Officer

Shri. S.R. Narayanan - *Asst. Adm. Officer*
" M. Ramakrishnan - *Supdt.*
" V.M. Mariappan - *Asst.*
" A. Kajendran - *Asst.*
" K. Maragathavadivelu - *Asst.*
" S. Nagarajan - *Asst.*

Senior Clerks

Shri. V. Chandran
" P. Selvaraj
" A. Yagappan
" N. Natarajan
Ms. N. Gomathy - *Jr. Stenographer*

Junior Clerks

Shri. S. Muthumari
Ms. S. Parisa
" M. Rameshwari

Supporting Staff

SSG - IV

Laboratory Attendants

Shri. K. Muthuramalingam
" M. Chinnasamy
" A. Muniasamy
" A. Raman - *Fieldman*
" R. Nagen - *Fieldman*

SSG-III

Laboratory Attendants

Shri. S. Muthuramalingam
" S. Mohamed Yousuff
" M. Ibrahimsa
" K. Gopalakrishnan

Fieldmen

Shri. A. Subramanian
" S. Mani
" S. Pitchai - *Daftry*

Watchmen

Shri. R. Sonai
" K. Muthiah
" M.Ramu
" P. Kuruppiah
" K. Muniasamy
" M. Govindaraj
" G. Saivadurai

Safaiwalas

Shri. R. Sevugan
" M. Muthu
" V. Santhanam
" K. Kuruvan
" A. Mari
" R. Alagan

SSG–II

Shri. M. Athimoolam -*Cook*
" Y. Balu – *Oilman*

Watchmen

Shri. K. Vellayan
" P. Ramu
" S. Arulsamy
" M. Thangavelu

Safaiwalas

Shri. L. Sathan
" G. Ankaiah
Ms. J. Kondamma
Shri. K. Gurusamy
Ms. S. Nagammal
Shri. R. Sonaimuthu
" K. Subramanian
" S. Arumugham
" S. Murugan
" N. Nagamuthu
" A. Palanichamy - *Messenger*

SSG-I

Laboratory Attendants

Shri. S. Muruga Boopathy
" N. Ramakrishnan
" C. Ramadas
" E. Natarajan
" A. Yesudas
" K. Jeevanantham
" M. Bareen Mohamed
" M. Seeni
" K. Shanmuganathan
" K.U. Raman - *Khalasi*

Fieldmen

Shri. M. Kuberaganeshan
" K. Thangavel
" P. Villan
" N. Boominathan
" S.M. Sikkender Batcha
" J. Padmanathan
" T. Thangarajan - *Oilman*
" M. Shahul Hameed - *Messenger*
" B. Thangaraj - *Lascar*
" K. Govindan - *Khansama*
" J. Hameed Sultan - *Pump Driver*
" G.K. Rajan - *Pump Driver*
" V. Narasimmabharathi *Daftry*

Watchmen

Shri. S. Balakrishnan
" V. Alagan
" N. Rajavelu

Safaiwalas

Shri. U. Rajendran
" S. Murugan
" N. Nagamuthu

Nagapattinam Field Centre

Technical Assistants (T-I-3)

Shri. V. Sivasamy
Shri. V. Thanapathi
" R. Somu

Pattukottai Field Centre

Shri. N. Vaithanathan - *Tech. Asst. (T-I-3)*
" K. Palani - *Jr. Tech. Asst. (T-2)*
" A. Kumar - *Jr. Tech. Asst. (T-2)*

Veraval Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri. Y.D. Savaria
" H.K. Dhokia
" B.P. Thumber

T-2

Shri. M.S. Zala - *Jr. Tech.Asst.*
" G.N.Chudasama -*Motor Driver*

T-I

Field Assistants

Shri. A.A. Ladani
" A.P. Bharada
" J.P. Polara
" J.D. Vanvi

Administrative Staff

Shri. J.N. Jambudiya - *Jr. Clerk*
" M.M. Vanvi - *Jr. Clerk*

Supporting Staff

SSG-II

Watchmen

Shri. Asiri Abu Bin Mehsan
" L.M. Waghela
" H.M. Bhint - *Messenger*

SSG-I

Shri. H.K. Makwana - *Fieldman*
" S.P. Makwana - *Watchman*

Jamnagar Field Centre

Shri. B.V. Makadia - *Jr. Tech. Asst.*

Bombay Research Centre

Technical Staff

Shri. M. Shriram - *Tech. Officer (T-5)*

Technical Assistants

T-II-3

Shri. K.B. Waghmare

T-I-3

Shri. J.L. Oza.
" C.J. Josekutty
" A.D. Sawant

T-2

Junior Technical Assistants

Shri. J.D. Sarang
" J.R. Dias
" B.B. Chavan
" P.S. Gadankush - *Motor Driver*

T-I

Field Assistants

Shri. A.Y. Mestry
" B.G. Kalbate
" J. S. Hotagi
" Thakur Das

Administrative Staff

Shri. B. Vijayakumar - *Assistant*
Ms. P.V. Shanbhag - *Sr. Clerk*
Shri. M.R. Wadadekar - *Sr. Clerk*
Ms. A.A. Sawant - *Jr. Clerk*
Shri. R.D. Medar - *Jr. Steno*

Supporting Staff

SSG-IV

Shri. B.T. Talpade - *Lab. Attendant*
" R.B. Bhangare - *Fieldman*

SSG-II

Shri. K.G. Tawade - *Watchman*

SSG-I

Watchmen

Shri. D.D. Jangam
" S.M. Tandel
" M.P. Jadhav
Ms. Urmila S. Balmiki- *Safaiwala*
Shri. P.S. Salvi - *Messenger*
Ms. Rajani Sakharam Tambe - *Messenger*
Shri. K.K. Baiker - *Fieldman*

Janjira – Murud Field Centre

Shri. D.G. Jadhav - *Jr. Tech. Asst.*

Rander Field Centre

Shri. S.D. Kamble - *Field Asst.*

Dahanu Field Centre

Shri. S.K. Kamble - *Field Asst.*

Ratnagiri Field Centre

Shri. B.N. Katkar - *Jr. Tech. Asst. (T-2)*
" D. Sawant - *Field Asst.*

Malvan Field Centre

Shri. K.R. Mainkar - *Field Asst.*
" B.S. Melinmani - *Field Asst.*

Karwar Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri. C.K. Dinesh
" N. Chennappa Gowda
" V. Varadaiah - *Motor Driver*

T-2

Shri. T.B. Harikantra - *Jr. Tech. Asst.*

T-I

Field Assistants

Shri. V.M. Dhareshwar
" U.V. Arghekar
" S.V. Pai
" K.C. Pandurangachar
" M.M. Bhaskaran
" N.G. Vaidya
" M.E.Durgekar - *Lascar*

Administrative Staff

Shri. G.K. Kudalkar - *Asst.*
" Y.H. Gamanagatti - *Sr. Clerk*

Junior Clerks

Shri. Gangadhar B. Naik
" Ganesh R. Nadig

Supporting Staff

SSG-IV

Shri. G.M. Korar - *Fieldman*

SSG-II

Shri. M.P. Harikantra - *Oilman*

Watchmen

Shri. L.K. Suvarna
" M.R. Kotharkar
Shri. M.B. Kotharkar

SSG-I

Ms. Somi M. Harijan - *Safaiwala*
Shri. Chandrakant G. Ulvekar - *Fieldman*

Watchmen

Shri. Thimmappa B. Gonda
" Somayya S. Gonda
" H.C. Naik

Goa Field Centre

Shri. Ramesh B. Kamble - *Field Asst.*
" Prakash C. Shetty - *Field Asst.*
" Subash K. Naik - *Messenger*-(SSG-I)

Mangalore Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri. G. Subramanya Bhat
Ms. Alli. C. Gupta
" Uma S. Bhat
Shri. B. Sridhara
" D. Nagaraja
" S.Kemparaju

T-2

Shri. Y. Muniyappa - *Jr. Tech. Asst*
" H.Vasu - *Serang*

T-1

Field Assistants

Shri. V. Lingappa
" C. Purandhara
" H.S. Mahadevaswamy
" C.H. Vaman Naik
" R. Appaya Naik
" M. Chaniappa

Administrative Staff

Shri. Balakrishna Naik - *Asst.*
" K.M. Abdulla - *Sr. Clerk*
" K. Rama Naik - *Sr. Clerk*
Ms. Martha R. Mascarenhas - *Jr. Clerk*

Auxiliary Staff

Shri. P. Narayana Naik -
Driver (light vehicles)

Supporting Staff

SSG-II

Shri. U.B. Sadashiva - *Lascar*
" Mohan S. Puthran - *Oilman*

Watchmen

Shri. Ramanna Sapaliga
" A. Keshava
" D. Gangadhara Gowda

SSG-I

Shri. U. Purandara Shetty - *Lab. Attendant*
Ms. Padmavathy - *Safaiwala*
Shri. M. Radhakrishnan - *Messenger*
" Mahalinga Naik - *Watchman*

Bhatkal Field Centre

Shri. Maruti Shankar Naik - *Jr. Tech. Asst.*
" Ganesh Bhatkal - *Field Asst.*

Calicut Research Centre

Technical Staff

T-5

Technical Officers

Shri. K. Nandakumaran
" K.K. Balasubramanian
" K. Soman
Ms. S. Lakshmi
Ms. K. Koumudi Menon
Shri. T. Girijavallabhan

T-4

Shri. C.K. Krishnan - *Sr. Tech. Asst.*

T-I-3

Technical Assistants

Shri. K.P. Vishwanathan
Ms. P. Swarnalatha
" V.K. Janaki
Shri. V.G. Surendranathan

T-2

Ms. Lalitha Sekharan

Administrative Staff

Shri. B.D. Puthran - *Asst.*
Ms. P. Subhadra - *Sr. Clerk*
" C. Kamalakshi - *Sr. Clerk*
Shri. R. Sreenivasan - *Jr. Clerk*
Ms. K.P. Shylaja - *Jr. Clerk*

Auxiliary Staff

Drivers for light vehicles

Shri. B.K. Velukutty
" P. Harshakumar

Supporting Staff

SSG-IV

Shri. K. Janardhanan - *Fieldman*
" V.K. Krishnankutty - *Lab. Attendant*
" M. Ramadasan - *Lab. Attendant*

SSG-III

Shri. K. Kumaran- *Fieldman*

SSG-II

Watchmen

Shri. K.E.J. Victor

Shri. K. Chekkutty
" A. Sivadasan

SSG-I

Ms. P. Renuka - *Lab. Attendant*
Shri. P.K. Suresh Babu-*Watchman*
" M.K. Chandran - *Safaiwala*
" Palaniappan - *Safaiwala*
" K.T. Mohanan- *Messenger*

Fieldmen

Shri. Thirumangalath Koman
" P. Dasan
" T.P. Renil Kumar
" T. Haridasan

Cannanore Field Centre

Shri. K. Chandran - *Tech. Asst. (T-I-3)*
" K.C. Purushothaman -
Field Asst. (T-1)

Vizhinjam Research Centre

Technical Staff

T-5

Technical Officers

Shri. K. Ramachandran Nair
" P.S. Sadasiva Sarma
" R. Bhaskaran Achari
" Jacob Jerold Joel
" S.G. Vincent
" K. Ramakrishnan Nair
" T.G. Vijaya Warrier

T-4

Shri. R. Vasanthakumar - *Sr. Tech. Asst.*

T-II-3

Shri. Thomas Teles - *Bosun*

T-I-3

Technical Assistants

Shri. A.K. Velayudhan
" K.T. Thomas
Ms. T.A. Omana
Shri. V.M. Alwaris - *Sr. Deckhand*

T-2

Shri. S.Ramachandran Nair - *Motor Driver*
" K.C. Gopalan - *Cook*

Senior Deckhands

Shri. P.M. Hariharan
" V.P. Benziger
" P. Hillary

T-I

Shri. K. Sasidharan Pillai - *Field Asst.*

Administrative Staff

Senior Clerks

Shri. M. Abdul Salam Sahib
" S. Erishikesan
" M. Reghunathan
" C. Johnson - *Junior Clerk*

Supporting Staff

SSG-IV

Laboratory Attendants

Shri. J. Anselam
" C.M. Rajappan
" V. Sasidharan Pillai

SSG-III

Shri. A. Ayyappadas - *Peon*
" K. Chandran - *Safaiwala*

SSG-II

Shri. S. Antony - *Messenger*

Watchmen

Shri. V. Viswanathan
" R. Madhusudhanan Nair
" V. Kochunarayanan Nair

SSG-I

Shri. B. Prabhakaran - *Messenger*

Tuticorin Research Centre

Technical Staff

T-6

Shri. A. Bastian Fernando - *Tech. Officer*

T-5

Technical Officers

Shri. C.T. Rajan
" R. Gurusamy
" A. Agastheesapillai Mudaliar
" P. Ferozkhan - *Bosun*

T-4

Shri. T.S. Balasubramanian - *Sr. Tech. Asst.*
" J. X. Rodrigo -*Sr. Tech. Asst.*

Technical Assistants

T-II-3

Shri. A.D. Gandhi
" N. Palanisamy

T-I-3

Shri. D. Sundararajan
" O.M.M.J. Habeeb Mohamed
" M. Chellappa
" M. Selvaraj
" M. Manickaraja
" G. Arumugam
" K. Srinivasagam
" S. Rajapackiam
" M. Enose
" E. Sivanandam - *Cook (Boat)*

Skin Divers

Shri. A. Dasman Fernando
" F. Soosai V. Rayan

T-2

Shri. P. Muthukrishnan - *Skin Diver*
" N. Jesuraj - *Skin Diver*
" Xavier Mohandoss - *Motor Driver*
" K. Alagirisamy - *Motor Driver*

T-1

Shri. R. Ponniah - *Electrician*

Field Assistants

Shri. K. Shamugasundaram
" S. Mohamed Sathakkathullah
" R. Athipandian
" K. Jeyabalan
" K. Paul Sigamony

Deckhands

Shri. D. Bosco Fernando
" S. Enasteen
" R. Arockiasamy
" D. Anandan

Administrative Staff

Shri. N. Rajamunisamy - *Supdt.*
" D. Ganajebamani - *Asst.*

Senior Clerks

Shri. S. Jeyachandran
" B. Bavanandam
" S. Antony George Ratnam
Ms. S. Leelavathi - *Jr. Stenographer*

Junior Clerks

Ms. Kamala Venkataraman
Shri. M. Samuthiram
Ms. S. Sarada
" C. Rajeswari

Auxiliary Staff

Shri. S.K. Gurusamy - *Motor Driver*

Supporting Staff

SSG-IV

Shri. A. Francis - *Lab. Attendant*

SSG--III

Shri. M. Ramadoss-*Lab. Attendant*
" D. Motcham - *Daftry*

SSG-II

Watchmen

Shri. M. Alfred
" M. Thangavelu
" K. Thangarajan
" P. Muthumalai
" V. Samayamuthu
Ms. S. Daisy - *Safaiwala*
Shri. R. Uchimahalai - *Fieldman*

SSG-I

Shri. K. John James - *Gardener*
" I. Syed Sadiq - *Lab. Attendant*
" V. Muniasamy - *Lab. Attendant*

Fieldmen

Shri. W. Sathyavan Nellraj
" K. Muthuvel
" P. Kandan
" M. Sankaran
" G.S. Rayappan
" I. Ravindran
" S. Alagesan
" S. Ganesan

Safaiwalas

Shri. M. Mariappan
" M. Soundarapandian

Watchmen

Shri. N. Asok Kumar
" M. Shanmughavelu

Kanyakumari Field Centre

Shri. N. Retnaswamy - *Tech. Officer (T-5)*
" I.P. Ebenezer *Tech. Officer (T-5)*
" A. Prosper - *Jr. Tech. Asst.*

Madras Research Centre

Technical Staff

T-6
Shri. P.K. Mahadevan Pillai - *Tech. Officer*

T-5

Technical Officers

Shri. S. Kandasamy
" M. Mohamed Sultan
" A.C. Sekhar
" S.K. Balakumar
" P. Ramadoss

T-4

Shri. K.S. Krishnan - Sr. Tech. Asst.

T-II-3

Technical Assistants

Dr. R. Thangavelu
Shri. V. Selvaraj
" U. Alagumalai - *Bosun*

T-I-3

Shri. L. Jayashankaran
" H. Kader Batcha
" S. Subramani
" S. Seetharaman
" Hameed Batcha
" C. Manimaran
" G. Sreenivasan

Shri. P. Poovannan
" K. Shahul Hameed
" S. Chandrasekhar
" P. Thirumilu
" G. Natarajan - *Motor Driver*
" K. Pandi - *Motor Driver*
" K. Rathnakumar - *Motor Driver*

T-2

Junior Technical Assistants

Shri. S. Mohan
" A. Ahmed Kamal Bhasha
" V.S. Gopal
" D. Padmanabhan - *Boat Driver*
" Vali Mohamed - *Boat Driver*

Deckhands

Shri. K. Parasuraman
" C. Manibal

T-1

Shri. A. Vairamani - *Field Asst.*

Administrative Staff

Assistants

Shri. K.M. Karuppiah
" S. Mangalam

Senior Clerks

Shri. S.K. Murali
" S. Balasubramanian
Ms. M. Parvathy
" G. Abitha
" Rosy Joachin - *Jr. Steno.*

Junior Clerks

Ms. A.B. Lalitha
" P. Thankaleelal

Auxiliary Staff

Deckhands

Shri. Joseph Xavier
" S. Selvanidhi

Supporting Staff

SSG-IV

Shri. M. Vellayan - *Lab.Attendant*

SSG-II

Shri. M. Ravindran - *Messenger*
" G. Vijayarangam - *Safaiwala*

Watchmen

Shri. R. Anandha Jyothi
" A. Janagiraman
" G. Chakkrapani

SSG-I

Shri. S. Yuvarajan - *Lab. Attendant*
" P. Selvaraj - *Safaiwala*
Ms. Aiyali Devi - *Peon*
Shri. M. Anbu - *Messenger*
" Sitaramacharyelu - *Helper*

Watchmen

Shri. T. Nagalingam
" S. Inbamani

Fieldmen

Shri. T. Manoharan
" R. Sundar
" R. Vasu

Cuddalore Field Centre

T-I-3

Technical Assistants

Shri. A Srinivasan
" T. Dhandapani

Shri. M. Radhakrishnan
" M. Manivasagam -
Jr. Tech. Asst. (T-2)

Pondicherry Field Centre

Shri. Chidambaram - *Tech. Asst. (T-I-3)*

Mahabalipuram Field Centre

Shri. S. Manivasagam - *Tech. Officer (T-5)*

Ongole Field Centre

Shri. K.V. Seshagiri Rao - *Tech. Officer*
" A. Hanumantha Rao- *Sr. Tech. Asst*
" S. Rajan - *Field Asst. (T-I)*

Nellore Field Centre

Shri. G.C. Lakshmaiah - *Tech. Officer (T-5)*
" G. Sudhakar - *Field Asst. (T-I)*

Kovalam Field Centre

Shri. S. Sankaralingam - *Tech. Asst. (T-1-3)*

SSG-II

Shri. D. Pakkiri - *Watchman*

SSG-I

Shri. M.P. Chandrasekhar - *Watchman*

Kakinada Research Centre

Technical Staff

T-4

Shri. P. Ramalingam - *Sr. Tech. Asst.*
" K. Ramasomayajulu - *Sr. Tech. Asst.*

T-II-3

Shri. K. Dhanaraju - *Tech. Asst.*

T-2

Shri. Ch. Ellithathayya - Jr. Tech. Asst.

T-1

Field Assistants

Shri. T. Nageswara Rao
" N. Burayya
" P. Venkata Ramana
" Vasamsetty Abbulu

Administrative Staff

Shri. S. Suryanarayana Murthy - *Sr. Clerk*
" S. Appa Rao - *Jr. Clerk*

Auxiliary Staff

Shri. K.Dharma Rao- *Driver (T-I-3)*

Supporting Staff

SSG-III

Shri. Narasimhamurthy - *Lab. Attendant*

SSG-II

Shri. S. Subramanyan - *Watchman*

SSG-I

Shri. S. Tatabbai - *Messenger*
" K. Satyanarayana - *Watchman*
" G. Sainyadhipathi - *Watchman*
" D. Bhaskara Rao - *Safiwala*

Machilipatnam Field Centre

Shri. T. Chandrasekhara Rao- *Tech. Asst.*

Narasapur Field Centre

Shri. P. Ananda Rao - *Tech. Officer (T-5)*

Visakhapatnam Research Centre

Technical Staff

T-5

Shri. C.V. Seshagiri Rao- *Tech. Officer*

T-4

Shri. K. Chittibabu - *Sr. Tech. Asst.*

T-II-3

Technical Assistants

Shri. K. Diwakar
" T.N. Sukumaran - *Bosun*

T-I-3

Shri. J.B. Varma
" S. Satya Rao
" M. Chandrasekhar
" M.S. Sumithrudu
" K. Narayana Rao
" A.K. Unnikrishnan - *Cook (Boat)*

T-2

Junior Technical Assistants

Shri. M. Prasad Rao
" P.A. Reghu- *Engine Driver*
" P. Pasupathi Rao- *Motor Driver*

Deckhands

Shri. S. Ganeshan
" P.Md. Abdul Moheedu

T-I

Field Assistants

Shri. S. Chandrasekhar
" R.V.D. Prabhakar

Administrative Staff

Shri. R. Appa Rao-*Asst.*
" Shanti Prasad - *Sr. Clerk*
Ms. B. Gouri - *Jr. Clerk*
" Madhavi Latha - *Jr. Clerk*

Auxiliary Staff

Shri. S. Dorai Pandian - *Driver (light vehicle)*

Supporting Staff

SSG-IV

Shri. V. Mohana Rao - *Lab.Attendant*

SSG-II

Shri. Rajan - *Peon*

Watchmen

Shri. R. Kanakaraju
" V. Demudu
" P. Krishna Rao
" L. Appa Rao - *Messenger*
" R. Dalayya - *Safaiwala*

Contai Field Centre

Shri. S.S. Dan - *Tech. Officer (T -9)*
" Sapan Kumar Ghosh - *T.A (T-II-3)*
" Pulin Behari Dey - *Jr. Tech. Asst.*
" Bijoy Krishna Burman - *Field Asst.*
" Swapan Kumar Kar - *Field Asst.*
" Prasanta Kumar Das -
(SSG-I) Messenger

Puri Field Centre

Shri. P.V. Krishna Rao- *Tech. Asst. (T-I-3)*
" Sukdev Bar - *Jr. Tech. Asst. (T-2)*
" S. Hemasundara Rao- *Field Asst. (T-I)*

Gopalpur Field Centre

Shri. Satchidananda Naik - *Field Asst. (T-I)*

Palasa Field Centre

Shri. V. Achutha Rao - *Tech. Asst.*

Srikakulam Field Centre

Shri. N.P. Chandrakumar -
Field. Asst. (T-I)

Minicoy Research centre

Technical Staff

Shri. V.A. Kunhikoya -*Tech. Asst* (T-II-3)
" Anasukoya - *Field Asst.* (T-I)

Ministerial Staff

Ms. M. Safayabi - *Jr. Clerk*

Supporting Staff

SSG-III

Laboratory Attendants

Shri. C. Mohammed Koya
" K. Kunjukunju
" P.I. Koya - *Watchman*

SSG-II

Watchmen

Shri. O. Ismail
" N. Pookoya

SSG-I

Shri. M.P. Mohammed Khaleel- *Fieldman*

Krishi Vigyan Kendra/Trainers' Training Centre

Technical Staff

Technical Officers

Shri. K. Asokakumaran Unnithan (T-7)
Dr. P.K. Martin Thompson (T-7)
Shri. K.N. Rasachandra Kartha (T-6)
" A.N. Mohanan (T-5)
" P. Radhakrishnan (T-5)

T-4

Shri. B. Suresh Kumar - *Sr. Tech. Asst.*
Ms. P. Sreelatha - *Training Asst.*

T-2

Motor Drivers

Shri. C.S. Xavier
" P.J. Sebastian

Administrative Staff

Shri. C. Balamamundinathan - *Asst.*
" C.D. Manoharan - *Jr. Steno.*
" N.K. Mohanan - *Jr. Clerk*

Supporting Staff

SSG - III

Fieldmen

Shri. K. P. John
" N.K. Asokan

SSG-II

Shri. K.N. Balan - *Fieldman*

SSG-I

Shri. K.G. Bhaskaran Nair - *Messenger*
Ms. Chinnamma Anjelo - *Safaivala*

Address List of Field Centres

(Arranged alphabetically)

Alleppey Field Centre of CMFRI
Geetha Building, Kalarcode
Alleppey - 688 003, Kerala

Bhatkal Field Centre of CMFRI
Room No. 72, Municipal Rest House
Near Old Bus Stand, Bhatkal - 581 320
Uttara Kanara, Karnataka

Cannanore Field Centre of CMFRI
Aykara Police Station Building
Cannanore - 670 017, Kerala

Chavakkad Field Centre of CMFRI
Chavakkad - 680 506
Trichur District, Kerala

Contai Field Centre of CMFRI
Thanapukur Par, Contai - 721 401
Midnapur District, West Bengal
Phone: 254

Cuddalore Field Centre of CMFRI
No. 106, Irusappa Chetty Street
Cuddalore Port - 697 003
South Arcot District, Tamil Nadu

Dahanu Field Centre of CMFRI
Kirtane Bungalow, Mangailwada
Dahanu, Thana District, Maharashtra

Goa Field Centre of CMFRI
Shri P.R. Phal House, Ist Floor
B.B. Borkar Road
Alto-Porvorim - 403 521, Bardez, Goa

Gopalpur Field Centre of CMFRI
Door No. 44, Big Street
Gopalpur-on-sea P.O.
Ganjam District, Orissa

Jamnagar Field Centre of CMFRI
Milan Chambers, Khodiyar Colony
Aerodrome Road
Jamnagar - 361 006, Gujarat

Janjira Murud Field Centre of CMFRI
14/3, Ground Floor, Bazar Peth Road
Janjira Murud - 401 401
Raigad District, Maharashtra

Kanyakumari Field Centre of CMFRI
Kanyakumari - 629 702, Tamil Nadu

Kovalam Field Laboratory of CMFRI
Kovalam - 602 112
Chengulpet District, Tamil Nadu
Phone: 52

Machilipatnam Field Centre of CMFRI
17/229, Sidimbi Agraharam Lane
Chilakalapudi - 521 002
Machilipatnam, Andhra Pradesh

Mahabalipuram Field Centre of CMFRI
Door No. 251, West Raja Street
Mahabalipuram - 603 104
Chengulpet District, Tamil Nadu

Malvan Field Centre of CMFRI
Municipal House No. 2799/3
Dawoolwada, Pawarchal
Malvan - 416 606, Maharashtra

Narasapur Field Centre of CMFRI
Door No. 9-2-64, Church Road

Narasapur - 534 275
West Godavari District
Andhra Pradesh

Nagapattinam Field Centre of CMFRI
C/o Inspector of Fisheries
Salt Road, Nagapattinam - 611 001
Thanjavur District, Tamil Nadu

Nellore Field Centre of CMFRI
Room No. 14, Municipal Buildings
Near AC, Bubba Reddy Statue
Trunk Road, Nellore - 524 001
Andhra Pradesh

Ongole Field Centre of CMFRI
No. 49, A.P. Housing Colony
Manidipakam, Ongole - 523 002
Prakasam District
Andhra Pradesh

Palasa Field Centre of CMFRI
Viswanatham Hospital Road
S. Kotta Street, Palasa - 532 221
Srikakulam, Andhra Pradesh

Pattukottai Field Centre of CMFRI
Room No. 23, Periaswamy Building
187/A, Big Bazar Street
Pattukottai - 614 601, Tanjor Dist.
Tamil Nadu

Pondicherry Field Centre of CMFRI
C/o Office of the Dy. Director of Fisheries (HQ)
190-Chinna Subarayalu Street
Pondicherry - 605 001

Puri Field Centre of CMFRI
Santikeenja Lane
Near Hotel Sea 'n Sand
Chakrathirtha Road
Puri - 752 002, Orissa

Quilon Field Centre of CMFRI
Municipal Stadium Building
Ward No. VIII, Door No. 737
Quilon, Kerala

Rander Field Centre of CMFRI
3/213, Bandaniwad, 'Devikripa'
Ist Floor, Randarai Ward, Rander
Surat - 395 005, Gujarat

Ratnagiri Field Centre of CMFRI
Building No. 3615, Devchand Nivas
Lower Lane
Ratnagiri - 415 612, Maharashtra

Srikakulam Field Centre of CMFRI
Door No. 8-15-68, Ring Road
Near Head Post Office
Srikakulam - 532 002, Andhra Pradesh

Budget expenditure statement for the year 1992-'93

	Account Heads	Non-Plan		Plan	
		Budget Estimates Rs. (lakhs)	Expenditure Rs. (lakhs)	Budget estimates Rs. (lakhs)	Expenditure Rs. (lakhs)
1.	Establishment Charges	409.20	428.80	1.00	–
2.	T.A.	8.80	8.81	5.60	5.59
3.	Other Charges	79.00	59.97	68.85	64.57
4.	Equipments				
5.	Fellowship Scholarships/Awards	3.00	2.33	6.00	4.89
6.	Grant-in-aid	–	0.11	–	–
7.	Works	–	–	18.55	24.92
	Total	**500.00**	**500.02**	**100.00**	**99.97**

केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान
कोचीन

वार्षिक रिपोर्ट
1992 - 93

भारतीय कृषि अनुसंधान परिषद्

संक्षिप्त विवरण, अधिदेश और संगठन व्यवस्था

वर्ष 1947 में केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान की स्थापना कृषि एवं सिंचाई मंत्रालय द्वारा हुई। 1967 में इसे भारतीय कृषि अनुसंधान परिषद के अधीन लाया गया। संस्थान का मुख्यालय कोचिन में और क्षेत्रीय केंद्र मंडपम केंप में स्थित है। इसके 11 अनुसंधान केंद्र और 29 क्षेत्र केंद्र हैं जो भारत के पूर्वी और पश्चिमी तटों में स्थित हैं।

संस्थान में मछलियों के प्रग्रहण और संवर्धन में क्रियाशील अनुसंधान कार्य गठित किये जा रहे हैं। देश की समुद्री मात्स्यिकी के समग्र विकास में इस संस्थान द्वारा महत्वपूर्ण योगदान दिया गया है। विदोहन की जानेवाली मात्स्यिकी संपदाओं का निर्धारण और मॉनीटरन द्वारा मछली संपदाओं का युक्ति-युक्त विदोहन केलिए सलाह और इसके परिरक्षण और प्रबंध; अनन्य आर्थिक मेखला का अपार समुद्री मात्स्यिकी संपदाओं का निर्धारण; पोत पर आधारित कार्यक्रम द्वारा पर्यावरण के परिवर्तन से समुद्री मात्स्यिकी संपदा की प्रचुरता में आता उतार- चढ़ाव का निरीक्षण; कारीगरी मत्स्यन, खतरे में पडे हुये पारिस्थितिक तंत्र और प्रदूषण से संबंधित तटीय पारिस्थितिकी का अध्ययन; फिन फिश और कवच प्राणी के उत्पादन केलिए अनुयोज्य समुद्री संवर्धन तकनोलजी का विकास; तकनोलजी का स्थानांतरण आदि में अनुसंधान गठित करने केलिए संस्थान का अधिकार है।

निम्नलिखित आठ प्रभागों द्वारा संस्थान अपने अनुसंधान कार्यों का कार्यान्वयन करता है। मात्स्यिकी संपदा निर्धारण प्रभाग, वेलापवर्ती मात्स्यिकी प्रभाग, तलमज्जी मात्स्यिकी प्रभाग, क्रस्टेशियाई मात्स्यिकी प्रभाग, मोलस्क मात्स्यिकी प्रभाग, मात्स्यिकी पर्यावरण प्रबंध प्रभाग, शरीरक्रिया विज्ञान, पोषण और रोगविज्ञान प्रभाग और सामाजिक व आर्थिक मूल्यांकन और तकनोलजी स्थानांतरण प्रभाग।

विज्ञान एवं प्रौद्योगिकी का कोचीन विश्वविद्यालय के सहयोग से संस्थान में समुद्री संवर्धन के स्नातकोत्तर कार्यक्रम के अधीन समुद्री संवर्धन में एम. एससी. और पी एच. डी कार्यक्रम गठित किए जा रहे हैं। पुस्तकालय और प्रलेख अनुभाग में संस्थान के छात्रों और कर्मचारियों व देश-विदेश के आंगतुकों के लिए हवाला देने की सुविधाएं हैं। संस्थान के प्रकाशनों के लिए भी यह अनुभाग उत्तरदायी है। नारक्कल के कृषि विज्ञान केन्द्र और प्रशिक्षकों का प्रशिक्षण केन्द्र द्वारा मछली प्रग्रहण और संवर्धन में प्रशिक्षण और विस्तार कार्यक्रम का आयोजन किया जा रहा है।

प्रभागवार सारांश

मात्स्यिकी संपदा निर्धारण प्रभाग

वर्ष 1992 के दौरान भारत का समुद्री मात्स्यिकी उत्पादन अनंतिम रूप से 2.29 मिलियन टन आकलित किया जो पिछले वर्ष से 44, 000 टन अधिक था। वेलापवर्ती और तलमज्जी मछलियाँ क्रमशः 52% और 48% थी। इस उत्पादन का 83% यांत्रिक गिअर से और बाकी अन्य यानों से प्राप्त हुआ। कुल उत्पादन में परिचम तट का उत्पादन 16,16,000 टन, और पूर्व तट का 6,70,000 टन था बाकी मछली द्वीप क्षेत्रों से प्राप्त हुई थी।

उत्पादन का क्षेत्रवार योगदान उत्तर पश्चिम क्षेत्र से 7,79, 928 टन, दक्षिण पश्चिम क्षेत्र से 8,25,889 टन, दक्षिण पूर्व क्षेत्र से 5,34,285 टन और उत्तर पूर्व क्षेत्र से 1,26, 408 टन अंकित किया गया। इनमें उत्तर पश्चिम क्षेत्र को छोडकर बाकी सभी क्षेत्रों के अवतरण में बढ़ती हुई है। उत्तर पूर्व क्षेत्र में हिल्सा शेड के अवतरण में 5000 टन की घटती और बंबिल के अवतरण में 11,000 टन की बढ़ती हुई है। दक्षिण पूर्व क्षेत्र में बांगडे के अवतरण में काफ़ी बढ़ती हुई है। दक्षिण पश्चिम क्षेत्र में 29,000 टन की बढ़ती और उत्तर पश्चिम क्षेत्र में 45000 टन की घटती हुई है।

दक्षिण पूर्व तट में तारलियों की मात्स्यिकी में थोडी कमी दिखाई पडी। बांगडा, करांजिड, फितामीन और टनियों का अवतरण बढ गया और स्टोलिफोरस और बंबिलों का अवतरण घट गया। तमलज्जी वर्गों में पर्चस, उपास्थिमीनों और क्रॉकेर्स के अवतरण में प्रगति हुई और अन्य वर्गों में घटती की प्रवणता दिखाई पडी है। पेनिआइड झींगों का अवतरण 1,87,000 टन (-3500 टन) और नॉन-पेनिआइड झींगों का अवतरण 91,000 टन और शीर्षपादों का 89,000 टन (+ 24000 टन) आकलित किया है।

यंत्रीकृत क्षेत्र का योगदान 83% था। मत्स्यन एवं नोदन की शक्ति हेने वाले एककों द्वारा 53% और मात्र नोदन की शक्ति होने वाले एककों द्वारा 30% पकड प्राप्त हुई है।

वेलापवर्ती मात्स्यिकी प्रभाग

इस प्रभाग ने हाल ही में शुरू की गई सात परियोजनाओं और एक अंतर प्रभागीय परियोजना के अंदर प्रमुख वेलापवर्ती संपादाओं की विशेषताओं का मॉनीटरन किया।

कोष संपाशों द्वारा 22375 टन तारलियों का अवतरण हुआ। टूटिकोरिन से गिल जाल द्वारा और मांगलूर-माल्प तथा विशाखपट्टणम से ट्रालरों द्वारा भी इनका शोषण किया गया। इसमें प्रमुख तारली थी। पश्चिम तट से कोष संपाश तथा अन्य गिअरों द्वारा 3077 टन श्वेत बेटों का अवतरण किया गया। बंबई से 280 टन सी. डसुमेरी का शोषण किया गया। कोचीन को छोडकर अन्य केन्द्रों में बांगडे की पकड में घटती हुई। जनवरी-मार्च के दौरान विशाखपट्टणम और काकिनाडा से आर. फॉगनी की बडी पैमाने में पकड हुई। गिल जाल, ट्रालर और कोष संपाशों द्वारा टूटिकोरिन से 335 टन, कोच्चि से 288 टन, कालिकट से 308 टन, मांगलूर-माल्प से 721 टन और वेरावल से 1450 टन सीर फिशों का शोषण किया गया। एस. कमेसन प्रमुख जाति थी। मांगलूर-माल्प क्षेत्र से कोष संपाशों द्वारा 4120 टन और गिल जाल द्वारा 332 टन ट्यूना का शोषण हुआ। कोचीन से 786 टन, विपिंजम से 1981 टन और मिनिकोय से 563 टन ट्यूना का अवतरण किया गया। इनमें ई. एफिनिस और ए. थासार्ड प्रमुख थे। मिनिकोय से कांटा डोर द्वारा के. पेलामिस की पकड की गई, यहाँ से 13 टन लाइव बेट मुख्यतः स्प्राटलोइड्स जातियों की पकड भी हुई। सौराष्ट्र और अर्नाला से डोल नेट द्वारा क्रमशः 35825 टन

और 1845 टन बंबिलों का अवतरण हुआ। सौराष्ट्र में पकड के 187 टन में किशोर शामिल थे। वेरावल, बंबई, मांगलूर, माल्प और काकिनाडा से 24000 टन फीतामीनों का अवतरण हुआ और इसमें अधिकांश पकड वेरावल से हुई। इन केन्द्रों से गिलनेट द्वारा 687 टन मछली का अवतरण हुआ। मांगलूर तथा माल्प से कोष संपाशों द्वारा क्रमशः 49 टन और 66 टन फीतामीनों का अवतरण किया गया। इस मात्स्यिकी में **टी. लेप्ट्यूरस** प्रमुख था।

मात्स्यिकी के पूर्वानुमान की परियोजना के भाग के रूप में तारलियों का आंकडा भी संग्रहित किया गया।

तलमज्जी मात्स्यिकी प्रभाग

इस प्रभाग के अनुसंधान कार्यकलाप हाल में शुरू हुए 7 परियोजनाओं तथा एक संवर्धन परियोजना के अंदर संपन्न हुए।

वर्ष के दौरान बंबई में 4112 टन, कोपिकोड में 525 टन, कोच्चि में 173 टन, टूटिकोरिन में 751 टन और मद्रास में 528 टन उपास्थिमीनों का अवतरण हुआ। इस मात्स्यिकी में **सी. लैटिकॉडस, सी. अम्बोइनेन्सिस, सी. लिम्बाटस, सी. मेलनोप्टोरा, आर. एक्यूटस** और मछली शामिल है। कुल 7122 टन पर्चस में मुख्यतः **ई. डयाकांतस, ई. ब्लीकेरी, ई. क्लोरोस्टिग्मा** और **ई. टॉविना** की पकड टूटिकोरिन, कोचीन और मंडपम से हुई।

शिंगटियों के अवतरण में बंबई को छोडकर सभी अन्य केन्द्रों में घटती दिखाई पडी। इसकी पकड कारवार में 10 टन और बंबई में 2948 टन आंकी गई। **टी. डसुमेरी, टी. थालासिनस, टी. सेराटस, टी. टेन्युस्पिनिस** और **ओ. मिलटारिस** पकडी गई मुख्य मछलियां थी। चुने गए 6 केन्द्रों में सूत्रपख ब्रीम की कुल पकड 21, 841 टन आकलित की गई। केन्द्रवार पकड में समानता नहीं देखी गयी। विशाखपट्टणम में 811 टन और कोचीन में 8090 टन पकड अंकित की गई। मात्स्यिकी में **एन. जापोनिकस, एन. मीसोप्रिओन** और **एन. डीलाग** प्रमुख थे। टूटिकोरिन और मद्रास में मुल्लन का अवतरण क्रमशः2567 और 4721 टन था और इसमें **एल. डसुमेरी, एल. बिंडस, एस. इंसिडयाटर** और **जी. मिनटा** प्रमुख थे। ट्रालरों द्वारा बंबई से 7113 टन, कारवार से 23 टन, कोपिकोड से 1198 टन, कोच्चि से 421 टन और विशाखपट्टणम से 295 टन क्रोकेर्स का अवतरण हुआ। इसमें **जोनिओप्स** जातियां, **जोनिअस** जातियां और **ओटोलिथस** जातियां प्रमुख हैं। तुम्बिलों का अवतरण मद्रास में सबसे अधिक (2238 टन) और टूटिकोरिन में सबसे कम (328 टन) अंकित किया गया। कोपिकोड में चपटी मछलियों के अवतरण में घटती देखी गई। कोच्चि और मंडपम में भी इसकी कम पकड हुई। गोट फिशस के अवतरण में 97-343 टन का रेंच देखा गया और श्वेत मछलियों का कोच्चि में 2 टन और मांगलूर में 154 टन देखा गया। टूटिकोरिन से 102 टन सूत्र पखों का अवतरण हुआ और **पी. माक्रोस्टोमा** इसकी प्रमुख जाति थी। कोच्चि से केवल 54 टन चपटी मछलियों का अवतरण हुआ।

मंडपम में संवर्धन और प्रेरित अंडजनन कार्यक्रम जारी रखे। संग्रहित किए गए 13 समुद्री बैसों में 13 को ध्यान की कमी के कारण चोट लगे और वे मर गए। लगभग 90 समुद्री बैसों को बढ़ाने के लिए ताल में रखा गया। समुद्री बैस के डिंभकों के खाद्य के रूप में **क्लोरेल्ला सलिना, ब्राकियोनस प्लिकाटिलिस, आर्टीमिया सलिना** और **मोइना माकूरा** का पालन किया गया।

क्रस्टेशिया मात्स्यिकी प्रभाग

वर्ष के दौरान पेनिअइड झींगों के अवतरण में न्यू फेरी वार्फ, तादी, शक्तिकुलंगरा, पारादीप और मंडपम में बढ़ती और वेरावल, कारवार, माँग्लूर, माल्प, कोचीन और विशाखपट्टणम में घटती देखी गई। वेरावल, न्यू फेरी वार्फ, तादी और शक्तिकुलंगरा में **पारापेनिआप्सिस स्टाइलिफेरा** पकड की मुख्य मछली थी। कारवार, कोचीन, मद्रास और

पाराद्वीप में **मेटापेनिअस डोबसोनी** प्रमुख थे। माँगलूर और काकिनाडा में **एम. मोनोसेरोस**, टूटिकोरिन और पाम्बन में **पी. सेमिसुल्काटस**, विशाखपट्टणम में **पी. इन्डिकस**, मंडपम और रामेश्वरम में **मेटापेनिआप्सिस स्ट्रिडुलन्स** पकड की प्रमुख मछलियाँ थी। केरल में मानसून के समय 21-6-92 से 12-7-92 तक सीमांतर्गत जलक्षेत्र से मछली की पकड रोकी गयी।

वर्ष के दौरान किये गये डॉल नेट परिचालन में पेनिआइड झींगों की पकड नवाबंदर और राजस्थान में ज्यादा थी तो वेरसोवा और न्यू फेरी वार्फ में कम थी। वेरावल और महाराष्ट्र में डोल नेट से मिली मुख्य मछली **असेटस** जातियाँ थी। ट्राल नेट परिचालन से महाराष्ट्र में मिली मुख्य मछली **नेमाटोपालेमन टेन्यूपस थी**।

पिछले कुछ वर्षों से बंबई में रेतीली महाचिंगट **थेनस आरियन्टालिस** की पकड में कमी महसूस की जा रही है। वर्ष 1985 में कुल महाचिंगट पकड का 46% यह जाति थी जबकि 92- 93 में यह सिर्फ 4% हो गयी। इस विशेष जाति का युक्तिहीन शोषण इसका कारण माना जाता है।

मंडपम के झींगा स्फुटनशाला में 21.6 लाख पेनिअस सेमिसुल्काटस परचडिंभकों का स्फुटन किया। मंडपम में नेत्रवृंत अपक्षरण के बिना पेनिअस सेमिसुलकाटस का प्रेरित अंडजनन किया है। एक ही झींगे ने आठ बार अंडों का निर्मोचन किया।

पी. इंडिकस नोप्लियों का परिवहन शत प्रतिशत अतिजीविता के साथ सफलता से किया गया।

मोलस्क मात्स्यिकी प्रभाग

वर्ष के दौरान शीर्षपादों का उत्पादन बढ़ गया। बंबई में ट्रालरों द्वारा इनका 2700 टन, मांगलूर माल्प में 2708 टन, कोच्चि में 6000 टन और मद्रास में 1893 टन शीर्षपाद मछलियों का अवतरण हुआ। अन्य केंन्द्रों में पकड कम थी। मलबार तट से 5100 टन **पी. विरिडिस** का शोषण किया गया। विषिंजम–कोलच्चल तट में 1674 टन **पी. इंडिका** का अवतरण हुआ। मुल्लिक ज्वारनदमुखी से 227 टन **एम. मेरेट्रिक्स** और कोच्चि से 240 टन **एस. स्क्रिप्टा** का शोषण किया गया। काली सीपी का उत्पादन कोच्चि में 7315 टन, वेच्चूर में 2653 टन, नेट्टूर में 319 टन और कुम्बलंगी में 244 टन था। पुलिकाट झील से उत्पादित 1931 टन सीपियों में **ए. ग्रैनोसा** प्रमुख था। टूटिकोरिन में स्थित स्फुटनशाला में **पी. फ्लूकेटा** के 73740 स्पाटों का उत्पादन किया गया। **सी. माड्रासेन्सिस** का 26 बार अंडजनन कराने पर 13 लाख स्पाटों का उत्पादन हुआ। नवंबर महीने में हुए चक्रवात के परिणाम स्वरूप जल की लवणता कम हो गई और यह सीपियों की मृत्यु का कारण बन गया। अष्टमुडी झील में **पी. मलबारिका** के 64000 और मुनम्बम में 8500 बीजों का रैंचन किया गया। कई प्रकार के शैवालों का संवर्धन जारी रखा। कालिकट में **नोक्टिलूका** की पुल्लिकाओं का असाधारण जमाव हुआ और हरित शंबू के जनन चक्र में इसका बुरा असर पडा। अध्ययनों से यह व्यक्त हो गया कि खाद्य शुक्ति के संवर्धन के लिए कारवार, काकिनाडा और मद्रास अनुयोज्य स्थान हैं। टूटिकोरिन में नबार्ड की सहयोगिता से अर्धवाणिज्यिक तौर पर खाद्य शुक्ति का उत्पादन किया गया। दिनांक 27-3-92 को टूटिकोरिन में खाद्य शुक्ति फसल मेला का आयोजन किया गया। तमिलनाडू के माननीय कृषि मंत्री श्री टी. जयकुमार ने मेला का उद्घाटन किया।

केन्द्रक रोपण किये गए कुल 15825 मुक्ता शुक्तियों में 13131 से एक, 2525 से दो और 162 से एक, दो और तीन मुक्ता प्राप्त हुए। स्थानीय मछुए लोगों की सहकारिता से वालिनोक्कम में मोलस्क, समुद्री, ककड़ी, समुद्री शैवाल, समुद्री बैस और झींगों की मिश्रित कृषि की गई। मई, 92 के दौरान कृषि के माननीय राज्य मंत्री श्री के .सी. लंका ने मुक्ता त्योहार का उद्घाटन किया। अध्ययनों द्वारा यह ज्ञात हुआ कि वालिनोक्कम क्षेत्र खाद्य शुक्ति और **पी. मलबारिका** के संवर्धन के लिए अनुयोज्य

नहीं है । यहां हरित शंबु और समुद्री शैवाल की सामान्य तौर पर मौसमिक कृषि की जा सकती है । झींगों, समुद्री ककड़ियों और समुद्री बैस का पंजर से संवर्धन किया गया और वातावरणीय प्राचलनों का मॉनीटरन भी किया गया ।

मास्त्यिकी पर्यावरण और प्रबंधन प्रभाग

माँगलूर, कोचीन, विषिंजम, टूटिकोरिन और मंडपम के उपतट समुद्रों की वातावरणीय प्राचलनों का अध्ययन किया । कोचीन में मई और नवंबर में समुद्रोपरितल का तापमान उच्चतम देखा गया । **नोक्टिलूका** की पुल्लिकाएं सितंबर में माँगलूर में और अप्रैल और जुलाई के दौरान कोचीन में देखी गयी ।

तटीय पानी का पारिस्थितिक प्राचलन संबंधी अध्ययन कायमकुलम, तोट्टप्पली, तन्नीरमुक्कम, अंधकारनषी पुतुपोन्नानि, कडलुन्डी, धर्मडम और कोरपुषा में किया गया ।

कोचीन व टूटिकोरिन में प्रदूषण सबंधी अध्ययन चलाया गया । मछलियों से बढ़कर कवचप्राणियों में धातुओं का अंश अधिक देखा गया ।

मिनिकोय में समुद्रीशैवालों के संवर्धन में 70 दिनों में 30 गुनी वृद्धि अंकित की गई । मंडपम में जी. इडुलिस के बीजाणुओं के संवर्धन पर किया गया अध्ययन बहुत ही प्रोत्साहजनक था ।

मछली की मेखलाओं के समुद्रोपरितल तापमान डाटा मांगकर्ताओं को दिया गया और इस पर प्राप्त सूचनाओं का परिशोधनार्थ विश्लेषण किये जा रहे ।

एफ ओ आर वी सागर संपदा के तीन पर्यटनों में जैविकी उत्पादकता के मौसमी व्यतियानों पर डाटा का संकलन किया ।

होलोथूरिया स्काब्रा और एच. अट्रा का स्पुटनशाला में पहली बार प्रेरित स्पुटन किया गया गया । **एच. स्काब्रा** के तरुणों को करपाड और वालिनोक्कम में आगे के अध्ययन केलिए छोड दिए ।

लक्षद्वीप की **अइरोपोटा** जाति के प्रशंख वैट बैंड रोग से पीडित देखी गयी ।

शरीर क्रिया विज्ञान पोषण एवं रोगविज्ञान प्रभाग

शरीर क्रिया विज्ञान

फिनफिशों तथा पेनिआइड झींगों की चुनी हुई जातियों में परिपक्वन का प्रभाव डालनेवाले एंडोक्राइनोलजिकल घटकों का अध्ययन किया गया । मैंटिस चिंगट, मुगंफली खली चूर्ण, सोयाबीन चूर्ण, कसावा चूर्ण, सीपी मांस, स्क्विड मांस, विटामिन और खनिजों से संपूरक करके जैव आमापन परीक्षणों (bioassay experiments) में उपयुक्त किए जाने वाले जीवों को देने केलिए खाद्य तैयार किया गया ।

एल. पार्सिआ, एस. सिहामा, एम. सेफालस, जी. फिलमेन्टोसस और जेरस जातियों के बीजों के क्रयो प्रिसर्वेशन में सफलता पाई । बीजों की गतिशीलता समान नहीं होने के कारण इस तरीके में कुछ परिवर्तन लाया और इसका अच्छा परिणाम निकला । गतिशीलता का निरीक्षण करने के लिए **एल. पार्सिआ** के बीजों को 6 महीने से एक वर्ष तक रखा गया । इन मछलियों में निषेचन अन्य जीवों से अलग देखा गया ।

खाद्य शुक्ति **सी. माड्रासेन्सिस** में 20-45% लवणता में रहने की सह्यता दिखाई पडी । लेकिन 25-35% की लवणता सब से अनुकूल देखी गई । **पी. मलबारिका** के लिए लवणता का अनुकूलतम रेंच 20-25% देखा गया ।

पोषण

पी एन पी/35 परियोजना के अंदर किए गए कार्यक्रम निम्नलिखित थे । घरेलू खाद्यों के गुणोत्कर्ष, देशज और आयात वाणिज्यिक खाद्यों का तुलनात्मक अध्ययन, झींगा संवर्धन की वातावरणीय विशेषताएं, रोगों का मॉनिटरन, खेतों में खाद्यों का पाच्यता परीक्षण और नेल्लूर खाद्यों का घटनात्मक अध्ययन ।

पी एन पी/41

बांगडों के ऊतक के एन्ज़ाइम का इलक्ट्रोफोरटिक स्क्रीनिंग अध्ययन और लोसी मूल्यों के पहचान के अध्ययन से कोचीन, तोट्टपल्ली और मांगलूर में इस मछली की जीवसंख्या में भिन्नता व्यक्त हो गई।

सामाजिक व आर्थिक मूल्यांकन और तकनोलजी स्थानांतरण प्रभाग

इस प्रभाग द्वारा 5 अनुसंधान परियोजनाएं चलाई गई।

एफ ई व ई/24.1

इस परियोजना में बालरामगुडी, डिघा पारद्वीप और शक्तिकुलंगरा में परिचालन किए जाने वाले ट्रालरों की आर्थिक कार्यविधियों का सर्वेक्षण किया और इन सर्वेक्षणों का विश्लेषण प्रगति से हो रहा है। आंध्रा प्रदेश में, साधारण ट्रालरों (10-12 मी) का अर्जन लागत वर्ष 1991 में 7.7 लाख रुपए, नियत लगत 2.62 लाख रुपए और लाभ 1.8 लाख रुपए आकलित किया गया है। छोटे ट्रालरों का पूंजी निवेश 3.9 लाख रुपए, नियत लागत 1.42 लाख रुपए और लाभ 0.8 लाख रुपए थे। दोनों प्रकार के ट्रालरों का पूंजी निवेश 3 वर्षों के अंदर वसूल किया जा सकता है। आर्थिक दृष्टि से साधारण ट्रालर मत्स्यन के लिए अनुयोज्य देखे गए है।

एफ ई व ई/24.2

मद्रास में दैनिक मत्स्यन के लिए प्रयुक्त किए जाने वाले गिल नेट एककों की सामान्य पकड, सकल राजस्व और परिचालन व्यय क्रमशः 106 कि.ग्रा 2096 रुपए और 1275 रु थे और दो दिन मत्स्यन एककों के लिए ये क्रमशः 120 कि . ग्रा 3600 रुपए और 2695 रुपए थे। टूटिकोरिन में गिल जाल का परिचालन आकर्षक नहीं था।

एफ ई व ई /26.1

गाँवों में तकनोलजी के स्थानांतरण कार्यक्रम के अंदर्गत नारक्कल के 28 कृषकों को झींगा /मछली बीज प्रदान किए गए। बोई के बीजों में 7 महीनों के अंदर 100-150 मि मी बढ़ती और एम. सेफालस के बीजों में 280-310 मि मी की बढ़ती देखी गई ।

एफ ई व ई/ 26.2

चेल्लानम और फोर्टकोच्चि में रहने वाली 25 स्त्रियों से मछुआ स्त्रियों की जीवन स्थितियों का आंकडा लिया गया। चेल्लानम के मत्स्यमहिलावेदी के सदस्यों को झींगा संवर्धन तकनोलजी का प्रदर्शन किया गया। कुक्कुट पालन की तकनोलजी के बारे में भी उन्हें समझाया गया।

आइ डी पी/3

वलय संपाश परिचालन के प्रति दिन का औसत राजस्व 6000 रुपए, परिचालन लागत 4500 रुपए और लाभ 1500 रुपए आकलित किया गया है। पुतियंगाडी में गिल जाल एकक की प्रति दिन की पकड 300 कि. ग्रा, कुल राजस्व 3300 रुपए और कुल लागत 2200 रुपए थे। मुनंबम में प्रति दिन की पकड 90 कि. ग्रा, राजस्व 1400 रुपए और कुल लागत 1000 रुपए थे। कांटा डोर के प्रतिदिन का औसत राजस्व 2600 रुपए और कुल आय 1100 रुपए अंकित किए गए। कम पूंजी निवेश और अच्छी आय मिलने के कारण छोटे ट्रालर अधिक लोकप्रिय बन गए हैं।

पुस्तकालय और प्रलेख अनुभाग

वर्ष के दौरान पुस्तकालय में 78 किताबें और 2011 पत्रिकाएं जोडी गई। मंडपम क्षेत्रीय केन्द्र और अन्य अनुसंधान केन्द्रों केलिए आवश्यक किताबें और पत्रिकाएं भी खरीदी गई। देश व विदेशों के माँगकर्ताओं को पुस्तकें देखने की और संदर्भ लेने की सुविधाएं प्रदान की गई। प्रकाशनों में आनेवाले चुने हुये लेखों पर आवश्यक सूचना देने की सुविधा

यहाँ " करन्ट अवेरनस सर्विस" के ज़रिए उपलब्ध है । पुस्तकलय में संस्थान के प्रकाशनों का संभाल और वितरण भी किये जा रहे हैं ।

वर्ष के दौरान निम्नलिखित प्रकाशन यहाँ से जारी किए हैं :

1. सी एम एफ आर आई स्पेशल प्रकाशन सं. 50,51,52
2. सी एम एफ आर आइ बुलेटिन सं. 45
3. सी एम एफ आर आइ न्यूज़लेटर सं. 54,55
4. मैरैन फिशरीस इन्फरमेशन सर्विस टी आन्ड ई सीरीस सं. 113 से. 117
5. रिसर्च हाइलैट्स 1991-92
6. सी एम एफ आर आइ वार्षिक रिपोर्ट 1991-92
7. दी इन्डियन एडिबिल ओयस्टर-ब्रोशर
8. दी इन्डियन मरीन पेर्लस--ब्रोशर

समुद्र जीव कृषि में स्नातकोत्तर कार्यक्रम

पाँच वरिष्ठ अनुसंधान अध्येताओं को विज्ञान और तकनोलजी का विश्वविद्यालय कोचीन से डाक्टरी उपाधि प्रदान की गई । एम एस सी अंतिम सेमस्टर के 11 विद्यार्थी नवंबर 92 में चलाई अंतिम परीक्षा में प्रथम श्रेणी में और दो डिस्टिंक्शन के साथ उत्तीर्ण हुये ।

समुद्री मात्स्यिकी में अनुसंधान एवं विकास के लिए अपेक्षित दीर्घवीक्षी योजना

संस्थान ने "समुद्री मात्स्यिकी में अनुसंधान एवं विकास केलिए अपेक्षित एक दीर्घवीक्षी योजना" पर प्रलेख (document) तैयार करके भा कृ अनु प को प्रस्तुत किया । इस प्रलेख में 9 मुख्य बातें शमिल हैं

1. शोषण की जानेवाली मात्स्यिकी संपदाओं का उचित प्रबंधन
2. अनन्य आर्थिक मेखला में 100 मी से परे के समुद्र में मात्स्यिकी संपदाओं का शोषण और उचित प्रबंधन
3. द्वीपी पारिस्थितिक तंत्र का अध्ययन
4. समुद्री संपदाओं और पारिस्थितिक तंत्र का परिरक्षण
5. तटीय मेखला प्रबंधन
6. समुद्री खेती द्वारा उत्पादन में बढ़ाव
7. संवर्धन योग्य समुद्री प्राणियों के शरीर क्रिया विज्ञान, पोषण, रोग विज्ञान और जैव तकनोलजी पर प्रारंभिक अध्ययन
8. समुद्री संवर्धन पर स्नातकोत्तर शिक्षा केलिए कोचीन में केन्द्रीय मात्स्यिकी विश्वविद्यालय की स्थापना
9. विस्तार शिक्षा तकनोलजी स्थानांतरण और प्रशिक्षण